Media Art and Future Technologies

Art at the Interface Between Lab and Gallery

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by
Sarah M. Schlachetzki
from Germany

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Introduction

What does the Japanese predilection for tea ceremony have to do with high-tech gadgets in a science museum? What is architect and designer Buckminster Fuller's connection to nanotechnology? And what does science, what does technology exactly have to do with art?

In my dissertation on media art and so-called 'future technologies' I want to shed light on media art's flirt with scientific ideas and technological development. The field of 'art and science' is currently flourishing, with a myriad of symposia, workshops, and exhibitions taking place every year that aim at illuminating the interaction of the two fields. At the same time, media art exhibitions and festivals present the newest of electronic art and its interrelationship with cutting edge high-technology of our time. At the latest since the *Experiments in Art and Technology* (E.A.T.), launched by engineer Billy Klüver and artist Robert Rauschenberg in the late 1960s, there has been an ongoing artistic interest in what science and technology can offer art – and, likewise, how art can contribute to the sphere of science and technology.

Much has been written about crucial differences, structural similarities, and striking interdependences of art, science, and technology. Within the field of art theory, the absolute majority of positions that do not immediately turn their back on an art dependent on electronics and computers has been eager to stress time and again how important the interaction of art and technology on the one hand and art's critical reflection of science and technology on the other hand have become for the beneficial evolution of our 'information societies'.

In two case studies I want to investigate the meaning of such entanglements. This art does not come out of the blue, rather I analyze it as always being part of a present moment, part of an economic situation, part of a rhetorical framework. In spite of connotations surfacing with the age-old call for its autonomy, art is integrated into current historical contexts with ensuing pre-conditions and restrictions. Media art is no exception, on the contrary, it is quite obviously a cultural practice of a society inevitably dependent on technology.

This dissertation is a contribution to a booming 'art-sci' phenomenon, ranging from media artist Eduardo Kac' genetically manipulated fluorescent bunny to art historian Ingeborg Reichle's "Art in the Age of Technoscience", from the Swiss Artists-in-labs Program to art exhibits at the Singapore Science Museum, from Ars Electronica's

preoccupation with a technologized nature to the Art|Sci Center at the University of California in Los Angeles. After Gyorgy Kepes' establishment of the Center for Advanced Visual Studies at the Massachusetts Institute of Technology in 1967 – a model institution of 'art and technology', after E.A.T. and several residency programs for artists in industrial laboratories, today we witness yet another surge of co-operations in artistic creativity and technoscientific development, a world-wide trend to a great extent (although limited to the first world, as is media art in general). In many ways it is the 'Two Cultures reloaded': two cultures – arts and humanities versus the sciences – whose opposing existence Charles P. Snow so emphatically bemoaned in his speech in 1959, when he called for their unison in the face of cold-war anxieties of the future.[1] Snow re-appears in many a publication on 'art and science' today. While some call for a surmounting of the gap between the 'two cultures', others already see the communicative trench between them finally overcome precisely by current art-sci and 'art and technology' endeavors.

One way to look at the very interrelation of art and science or technology is to pay attention to the media arts as the historical genesis of an artistic discipline and its emergence as part of – or parallel to – the contemporary art world. Another perspective, the one I am taking, is to have a look at art/science connections and raise questions about their significance from a mostly sociological point of view. The latter approach can be described as a close-up, perceiving selected artistic projects as representative of a broader current. In highlighting two cases – one of media art and technological development in Japan (for the field of 'art and technology'), the other one of media art's exploration of nanotechnology ('art and science') – I want to elaborate on structural characteristics of media art in general, at times precisely through dissimilarities and contrast of examples. It is always possible to find counter samples, cases proving the exact opposite of my point here. I deem the two cases under investigation, however, representative for much of what is going on in media art. They will illuminate not a totality, but a significant part of the field of 'art and science' as well as 'art and technology'.

In the evaluation of my two case studies I want to scrutinize actors' position-takings in what I understand as a cultural field according to Pierre Bourdieu's seminal work in

[1] Charles P. Snow, *The two cultures and the scientific revolution* (Cambridge: University Press 1959).

this area.[2] Artists, scientists, curators, and theorists are perceived as actors in a "field of cultural production" within which they position themselves actually and rhetorically through works and words. As I will show, the protagonists' positions are dependent on various factors such as economic circumstance and academic affiliation, also on the broader societal context and even national policies.

The art sociological approach will be combined with a discourse analysis in the third chapter, which overarches the first two on a meta-analytical level. In the third chapter I will still stay close to the material unfolded in the first two in order to obtain relevant assertions and avoid unjust generalization far off the analyzed matter. It will comprise an analysis of dominant rhetorics employed by actors in the field – rhetorics that set it up, serve to consolidate it not only in the institutional framework of media art centers, but also in academia, and that – last but not least – allow media art's access into the annales of art historical writing. I then also draw on a historical perspective in order to approach rhetorical parallels of media art and modernity as well as ontological ascriptions to the art at stake. After the first two chapters, in which I investigate position-takings of artists and theorists and how art is *displayed*, the last chapter will focus on how art is *described* and which role it plays within a historical framework.

The vast majority of contributions to the media art field in general and to 'art and technology' and 'art and science' specifically is all too often concerned with normative judgment of what is to be considered good and what is bad (media) art. Projects are discussed as a success in their respective niche or celebrated as pathbreaking for future developments. Among the few really critical voices, others do not refrain from utter resentment of the subject.[3] Most of the literature on the subject comes from authors linked in one way or the other to institutions promoting media art, such as art academies or media art centers. Protagonists active in the field – artists, curators, directors of centers for artistic research – inevitably have a biased perspective. There have only been very few critical analyses of the media art in focus, of the fields 'art and technology' and 'art and science'. Lately, there have been several contributions on art and science's recent co-operations. In her book *"Art after Science"* Susanne

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[2] Cf. Pierre Bourdieu, *The Field of Cultural Production. Essays on Art and Literature* (New York: Columbia University Press 1993).

[3] See for example Lewis Wolpert, "Strange Bedfellows. Superimposing art and science as kindred concepts may be fashionable, but is it justified?", *LabLit.com*, 18 July 2005, online source (Dec 6, 2010): "Trying to bring arts and science closer together is basically social snobbery, as scientists are still envious of the status of the arts and the humanities."

Witzgall has mostly focused on artworks of traditional media, not on media art.[4] She does touch upon the question of art's role in the age of technology and upon epistemological issues seminal in the debate on art and science, which shall also become central for my observations in the third chapter. Witzgall, however, is concerned with an overview of rather traditional artistic means and the artist's view *on* science rather than artworks *in* the science and technology context. Her statements thus cannot be extrapolated onto the field of a completely different art dependent on electronic media.[5] Next to conventional artworks Ingeborg Reichle's study on "art from the laboratory" analyzes many media artistic positions, mostly artists comprised under the term 'bioart', that is, works related to the so-called life sciences.[6] Director of the research project *WissensKünste* ("KnowledgeArts") at the Center for Literary and Cultural Research in Berlin, Sabine Flach has ongoingly published on the interrelationships of art and science. As *WissensKünste* declaredly focused on the question of how "artistic practices can be understood as a specific kind of knowledge and as interventions into the scientific discourse"[7], Flach's approach of the topic starts off on this premise.[8] The fact that these three exemplary contributions to the field stem from the German speaking academia is not accidental. It is linked to the funding context in Europe, especially in Austria, Germany, and Switzerland, where media art and specifically the field of 'art and science' have been widely promoted lately.[9] While Witzgall, Reichle, and Flach are art historians and not directly related to art academies, their outlook on the topic of art's flirt with science and technology is characterized by the above-mentioned thesis that art here decidedly exerts epistemic functions.

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[4] Susanne Witzgall, *Kunst nach der Wissenschaft. Zeitgenössische Kunst im Diskurs mit den Naturwissenschaften* (Nuremberg 2003). Witzgall discusses artistic positions from Cubism to Joseph Beuys, Hans Haacke, Marc Dion, or Damien Hirst.

[5] Witzgall comes to the conclusion that artistic positions of the 1990s and their "relationship to the natural sciences" can be characterized by the term 'non-modern' as coined by Bruno Latour; see ibid., esp. p. 336-338. The research material of this study does not support this for the cases in discussion.

[6] Ingeborg Reichle, *Art in the age of technoscience: genetic engineering, robotics, and artificial life in contemporary art* (Vienna 2009).

[7] www.zfl.gwz-berlin.de/forschung/projekte-bis-2007/wissenskuenste/ [In the following, the translation of foreign sources into English is always mine, unless otherwise indicated].

[8] E.g. Sabine Flach, "WissensBilder - Die Doppelhelix als Ikone der Gegenwart", in: Elke Bippus, Andrea Sick, eds., *Industrialisierung - Technologisierung von Kunst und Wissenschaft* (Bielefeld 2005), 64-82; ibid., "'It's not easy being green!'. Schnittpunkte von Kunst, Medientechnik und Naturwissenschaften am Beispiel der Transgenic Art", in: Martina Heßler ed., *Konstruierte Sichtbarkeiten. Wissenschafts- und Technikbilder seit der Frühen Neuzeit* (Munich 2006), 281-302.

[9] This is reflected in the established media art centers Ars Electronica in Linz or the ZKM in Karlsruhe, in programs like the Artists-in-labs Program at Zurich's University of the Arts, or also in research projects like the above-mentioned *WissensKünste*.

Especially Flach's and Reichle's contributions are engaged in the promotion rather than mere description of the field of 'art and science'.

The question of 'who speaks' is also noteworthy for the evaluation of the multitude of publications from authors linked to art academies bringing along the inevitable bias. Authors like Jill Scott and Stephen Wilson are both artists and professors in academia. In 2002 Wilson presented his *Information Arts. Intersections of Art, Science, and Technology* which has been a first and seminal overview of the field.[10] Both, also his later contributions and Scott's *artists-in-labs. Processes of Inquiry* are unavoidably colored by their affiliation.[11]

Against the backdrop of the literature's general tendency, I want to take a somewhat ethnographic, rather disinterested, view, if at all possible. It is not my intention to discuss how convincing, how good or bad works of Japanese so-called Device Art are, or how media art installations fascinatingly approach the nanosciences. I do not see any 'truth' revealed by the artworks in an untimely Heideggerian or Adornian tradition surprisingly still lingering on. Rather, I attempt an "unfamiliar" look at a research field that I have, trained as a historian of mainstream contemporary art, entered from its periphery.[12] Thus approaching media art and its interrelation with science and technology, I am conscious of the fact that ethnographies "do not prove anything", they do not offer "singly possible, authoritative descriptions".[13] Not only the choice of exemplary case studies, but also my view upon them is pre-conditioned by meaning created from a subjective standpoint. The specificity here is the sociological stance by which I illuminate phenomena of media art and its combination with an extrapolation onto the discursive level. The choice not to analyze the artworks in-depth was a conscious one. As my interest is to explore players and networks in funding contexts on the one hand, and rhetorical linings and underlying beliefs of these media art fields on the other hand, my main concern throughout the study is the analysis of rhetorics, not a work-immanent interpretation. The presented artworks, namely works subsumed

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[10] Stephen Wilson, *Information Arts. Intersections of Art, Science, and Technology* (Cambridge MA: MIT Press 2002).

[11] Jill Scott ed., *artists-in-labs. Processes of Inquiry* (Vienna et al. 2006).

[12] Cf. Klaus Amann, Stefan Hirschauer, "Die Befremdung der eigenen Kultur. Ein Programm", in: ibid. eds., *Die Befremdung der eigenen Kultur. Zur ethnographischen Herausforderung soziologischer Empirie* (Frankfurt Main: Suhrkamp 1997), 7-52, esp. p. 11.

[13] Ibid., p. 30. As a point of reference see Clifford Geertz, "Thick Description. Toward an Interpretive Theory of Culture", in: ibid., *The Interpretation of Cultures. Selected Essays* (New York: Basic Books 1973), 3-30.

under the label of Device Art and so-called nanoart, would certainly deserve a study closely examining their inherent logic and their function beyond the discourse which I aim to dissect. It might well be that under close scrutiny from a work-immanent angle several of the gadgets, installations, or related pieces will display characteristics dissimilar to the ones they assume in my study concerned with overall relationships. Next to my focus on broader (social and historiographical) contexts, there was a simple reason for abstaining from a detailed interpretation of the – most often – interactive artworks: their accessibility. Even though my research is based on extensive travel activity, I have personally not been able to see many of the installations. While I have had the chance to take a look at most of the Japanese Device Art objects, the nanoart works have been on display in places and at times that made it impossible for me to personally see and experience them.[14] This problem, which concerns art historical methodology in general and which is often ignored in contributions to the field of art (and architecture, for instance), is a central one in that it unbalances once more the author's sovereignty of interpretation. My approach thus *can*not be concerned with the inner logic of the artworks and their development of *meaning*. In my study the artworks rather serve as objects in a social field of cultural production, in networks of agents,[15] and as part of a discourse in one specific niche of media art – one closely tied to science and technology. I present one example of each sub-discourse: one of 'art and science' and one of 'art and technology'. My original wish to only focus on art and science co-operations has been thwarted and ultimately enriched by the striking absence of such projects in Japan. The answer to *why* this might be so constitutes the first chapter of my study concerned with art and its link to technological development in Japan. I thus discuss both fields – 'art and technology' and 'art and science' – in their dissimilarities but also the relationships between them.

These relationships and meanings become most relevant in the third chapter. Leaving firm observational grounds, here I enter much less solid interpretative terrain. I give up the close-up observation of actors, institutions, and artworks, in order to set

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[14] With the exception of *200 nanowebbers* by Semiconductor I have not had the chance to experience either of the interactive installations by Victoria Vesna and James Gimzewski, Anne Niemetz and Andrew Pelling, Paul Thomas, or Christa Sommerer and Laurent Mignonneau. The documentation of the works in texts and images has thus served as the basis of my analysis.

[15] My approach, however, does not expand into Bruno Latour's conception of human and non-human agents; cf. ibid., *We Have Never Been Modern* (Cambridge, MA: Harvard University Press 1993); ibid., *Pandora's Hope. Essays on the Reality of Science Studies* (Cambridge MA and London: Harvard University Press 1999).

prevailing rhetorics into a historical perspective. The central concern of this last chapter is a scrutiny of the media art discourse with regard to two sides evaluating the cultural present: 1) utopias of progress which have accompanied all of modernity and 2) their antipode – cultural criticism or the German *Kulturkritik*. I understand this scrutiny then, with Philipp Sarasin, as "the endeavor to analyze the formal conditions that control the production of meaning".[16] Today's media art production and its rhetorical context then appear as yet another reaction to a present perceived as rapidly changing by artists and theorists alike. This chapter follows an impetus preeminent in theorist Dieter Daniels' work. Daniels has repeatedly remarked the revival of "modernity's project" in media art.[17] For the discussion of art's relationship to technology and science with respect to theories of an accelerated present and a changed future, I lean on contributions by Georg Bollenbeck, and for a more philosophical level on Hans Ulricht Gumbrecht, Jean-François Lyotard and Bruno Latour.[18] Rhetorics of progress and field-immanent rhetorics of art's critical function in our techno-society (as upheld by Reichle, Flach, or philosopher Alfred Nordmann) are then set into relation with Lyotard's reflection upon what he calls *paralogie* – a critical counterweight to the restrictive techno-societal thought pattern.

In all this, I do not pertain to any school of thought or coherently stick to one theory as *the* red line running through the entire study. In the first two chapters – the case studies on which I shall extrapolate later on – I follow an art sociological methodology interested in revealing positions and connections of players in tightly knit networks of the media art field. Leaving this micro view and opening my approach toward the broader perspective and context, I do consider Lyotard's and Latour's ideas on history and periodization enormously valuable without, however, seeing the possibility to employ either one wholly and uncritically. My approach, which one might duly label positivistic in the first two chapters, is starkly contrasted with the third chapter on the belief in future and in technology to be found in the 'art and science' scene. Evaluations and conclusions of this last part of the dissertation stand on much less firm

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[16] Philipp Sarasin, *Geschichtswissenschaft und Diskursanalyse* (Frankfurt Main: Suhrkamp 2003), p. 33.

[17] See specifically Dieter Daniels, *Kunst als Sendung. Von der Telegrafie zum Internet* (Munich: C.H. Beck 2002).

[18] Georg Bollenbeck, *Eine Geschichte der Kulturkritik. Von Rousseau bis Günther Anders* (Munich: C. H. Beck 2007); esp. Hans Ulrich Gumbrecht, "Stagnation", *Merkur* 62 (Sept/Oct 2008), No. 9/10, 876-885 (Gumbrecht's ideas in turn are informed by Reinhardt Koselleck's seminal work; e.g. ibid., *Vergangene Zukunft. Zur Semantik geschichtlicher Zeiten* (Frankfurt Main: Suhrkamp 1989)); Jean-François Lyotard, *The Postmodern Condition. A Report on Knowledge* (Manchester: Manchester University Press 2004); esp. Latour 1993.

ground as they follow the reflection of highly complex interrelations. Here, with eminent scholars on the problem of thinking and writing 'history', the elaboration of the central question – as to which position phenomena like 'art & science' and 'art & technology' occupy not just in art's, but also our society's general quest – must entail uncertainty and inconclusiveness.

Media art does not come about without any presuppositions. It is bound to funding contexts and institutional affiliation. This dependence on the funding context is in itself nothing new: no one ever claimed art – any art – were not dependant on patrons, networks, the market. This said, my aim is to more closely examine a) a national funding context and its relevance for media art in Japan and b) the international appeal of labeling something 'nano' in media art.

I will show how media artists position themselves accordingly. So-called Device Art in Japan – gadget-like and potentially commercializable art objects – will be exemplary of how significant economic factors are in the support and promotion of art and technological development. In international 'nanoart' – artworks dealing with nanotechnology – it will become evident which role academia and public funding through science museums play in fostering the link between 'art and science'. The rhetorics employed by artists and promoters of these art forms are adapted to the respective funding situation in that they address key terms like industrializability and 'Japaneseness' in the first case, or a booming technoscience in our 'knowledge and information society' in the nanoart scene.

In both cases the concept of popularization is playing a crucial role. It concerns communicational processes between works of media art and their audience. While Device Art in Japan relates to the core of a society often described as a gadget-infatuated nation, the buzzword 'nano' in an art context immediately brings up notions of the public understanding of science and its popularization in galleries and science museums.

Against the backdrop of cultural criticism around 1900 addressing the living conditions under a painfully experienced change in the form of industrialization and in view of varying conceptions of an however shaped 'future' succeeding our present, I will show how media art around the year 2000 is still affected by interrelated tropes dating back to 'modernity': science and its language appealing to future and progress, the "disenchantment of the world" precisely through science and processes of

rationalization, and the ensuing *Kulturkritik* of technological advancements. Can an art form today dealing with science and technology still be indebted to a regime of unbroken hope for a technologized future or is there a substantial critique incorporated in these artworks as underline many media art theorists for the 'art and science' field?

Dissecting one example of successful media art in Japan and one of interactive installations in something often summarized as 'the West' by referring to Europe, the United States, and Australia, I set up a dichotomy, which methodologically immediately brings about difficulties, if set into stark contrast. I elaborate on interview material of interviews conducted in Japan and – mostly – in the United States. For the Japanese case surfaces the cliché of a neocolonialist view musing upon questions of 'Japonization'. In the second case, the problem is 'reduced' to exerting the author's sovereignty of interpretation over collected research material. The two problems have to stay unsolved. I try, however, to avoid an unjust essentialization of Japan and 'the West' by aiming not at a comparison of divergent samples, but at a presentation of two equal positions. Although questions of 'Japaneseness' will be brought up in the first chapter, the two case studies do not serve as examples of different *cultural* approaches of science and technology in media art. Rather, the analysis will stay true to the premise of investigating actors in a field of cultural production, by which the two fields will, after all, not appear essentially different.

Operating with categorizations such as 'art and science' and 'art and technology' makes it easier to refer to the two phenomena under scrutiny. Of course, the works grouped under these categories are not as homogeneous as claimed, the categories themselves being rather indistinct. Yet the simplification serves the better understanding of structurally differing phenomena: of media art and its interrelation with technological development and scientific vogue terms. While the compounds in other contexts, just like 'art & research', may comprise completely diverging artistic approaches, I use them here in order to highlight works of *media art*, not of traditional media like sculpture and painting or traditional installations like, for example, those of Suzanne Anker or Mark Dion. I am thus speaking about segments of media art. I do not claim to speak about media art *in general*, nor do I want to stress that there are not, also in the two fields under scrutiny, artistic positions which counter conclusions drawn in my study. However, in the third chapter I do dare an assessment of what the current 'art and science' boom means for prevailing thought patterns and outlooks of our society.

Especially in the last chapter, which offers a historical perspective on the art in focus, terms historicizing the past century are helpful for an evaluation of the present. I use the terms 'modernity' and 'postmodernity' being well conscious of the fact that they do not come without the cost of ambiguity. In order not to problematize the matter more than necessary, I employ 'modernity' for the epoch of about the second half of the 19th century up until the Second World War. My understanding of 'postmodernity' then follows the cited sources.[19] It is basically used as the self-description of the decades from the 1970s until today.[20] Already in the 1990s, Heinrich Klotz has introduced the term 'Second Modernity': a late modernity now historicizing 'post-modernity' as a problematic and excessively charged term.[21] Such linguistic shifts are an illustration of the perpetual trial to describe temporality, historical change, and art's role in it. Klotz develops his claim that the "media art of the Second Modernity opposes the [ideological] position of Classical Modernity" while he takes a look at a selection mainly of video art.[22] The selection of art presented in my dissertation does not support Klotz' thesis. After all, this leads back to the problem of representativity of selective research,[23] a problem which can only be countered, not neutralized, by conscientious evaluation. The third chapter with its glances on modernity and 'postmodern' media art will then tackle Peter Weibel's neat classification: "Whenever an art appears that deals with the dislimitation of art and life and their fusion, it perpetuates the project of modernity.[…] But art can also repudiate this project; then it will partially belong to postmodernity."[24]

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[19] Especially important will become Jean-François Lyotard's conception of the term with respect to an evaluation of what already in 1979 he called 'postmodern knowledge'.

[20] A differentiation in postmodernity, neo-modernity, and Second Modernity, as proposes Peter Weibel in 1996 (cf. footnote 24), in my opinion does not help clarify the debate for my purposes.

[21] Cf. Heinrich Klotz ed., *Die Zweite Moderne. Eine Diagnose der Kunst der Gegenwart* (Munich: C.H. Beck 1996), esp. p. 9.

[22] Ibid., p. 22.

[23] Cf. Amann/Hirschauer 1997, p. 15.

[24] Peter Weibel, "Probleme der Moderne – Für eine Zweite Moderne", in: Klotz 1996, 23-41, p. 26.

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Finally, I owe thanks beyond words to my parents and to my brother.

Linz, a medium-sized city in Austria. On the Hauptplatz, its main square not far from the river Danube, passers-by are invited to enter a big tent. *Japan Game* – a side event of Linz' annual media art festival Ars Electronica presents newest video games and game consoles for visitors to use. Adolescents group around the screens and get lost in gaming. Not openly advertized is the fact that the Japanese game manufacturer Nintendo has found a platform here to promote his newest products. Commercial game consoles within the framework of a media *art* festival? Architect and theorist Arata Isozaki speaks of a "*new* Japan-ness" now including "techno/comic goods and images" surfacing with the EXPO 1970 in Osaka (the EXPO which also saw the installation of the famous *Pepsi Pavillon* of the group of collaborating artists and engineers in the *Experiments in Art and Technology* (E.A.T.)).[25] Today, games and manga apparently have become the new Japonaiserie after especially in the 19th century Japanese aesthetics had flooded the European art market. While woodblock prints from the far East were appreciated as art in Western *salons*, they had emerged in Japan with an essentially commercial notion.[26] The commercial background of 21st-century game consoles in turn is evident. But what exactly is the connection between video games and an international spearhead of media art festivals?

In this chapter I want to illuminate such entanglements. I will take a look at historical peculiarities like the *import* of the Western concept of 'art' into Japan occurring roughly at the same time as a major *export* of Japanese prints. Such 19th-century imports and exports of (symbolic) goods during the Meiji-era in Japan will play a role just like the absence of any army-funding for the technology sector on the island after World War II, or the Japanese adaptation of the concept of media art. It is almost a commonplace that with its sky-rocketing technological development, Japan offers a unique breeding ground for all kinds of electronic art. Honda's famous robot ASIMO, the all-encompassing presence of technology in manga and anime, Japanese fascination with highly sophisticated cell phones – all this stands for an intense entanglement of technology and society in this Eastern Asian country. The often-cited

[25] Arata Isozaki, *Japan-ness in Architecture* (Cambridge MA and London 2006), p. 56 and 101.

[26] Cf. for example Marie-Thérèse Barrett, "Japonaiserie to Japonisme. A Revolution in Seeing", *The Transactions of the Asiatic Society of Japan*, Fourth Series, Vol. 14 (1999), 77-85, esp. p. 79; also Sarah Thompson, "The World of Japanese Prints", *Philadelphia Museum of Art Bulletin*, Vol. 82, No. 349/350, Winter-Spring 1986, 3-47, p. 4.

enthusiasm of the Japanese for advanced gadgetry and playful electronic items is part of Japan's own history of industrialization and technological progress. That Japan belongs to the 'capitalist trias' along with the USA and the European Union and that the three regions have been dominating between two thirds and three quarters of the world's economic activities in the 1990s[27] is telling in its own way and illustrates not only the island's industrial strength, but also its steep technological rise after almost complete economic and moral devastation due to World War II. Even though the visibility of Japanese art in a supposedly globalized art world does by no means correlate with its economic performance,[28] there is certain evidence that at least in 'new media art' Japan is more present than in other fields of contemporary art.[29] So what are the premises for media art's importance in Japan? What are the characteristics of the Japanese media art scene as an art in a 'technophoric' society? And in a more globalized art scene than all others, is there such a thing to be called 'Japanese media art'?

There are two main aspects of the seemingly unique situation in Japan. One aspect can be found in the institutional structures that foster the media art(s) (and the 's' is meaningful as will be shown). The other one is the discursive framework in which the uniqueness of the Japanese case is set up in Japan itself, that is how the very Japaneseness of media art is created discursively. In the end, the two aspects are closely interrelated, so the hypothesis put forth here.

1. Media Art in Japan – Institutional Structures

In order to trace back the beginnings of what can be subsumed under 'media art' in Japan, one might start with the avant-garde movement in the post-war era, as does media art scholar and curator Machiko Kusahara in her article "Considering media arts

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[27] Graham Thompson, "Economic globalization?", in: David Held ed., *A globalizing world? Culture, economics, politics* (London and New York 2000), 86-126, p. 110-111.

[28] Ulf Wuggenig, "Fiktionen, Mythen, Realitäten. Zentren, Peripherien und Kunst", in: Alvim, Fernando, et al., eds., *Next Flag. The African Sniper Reader. Eine Anthologie* (Zurich 2005), 24-55, p. 49-50.

[29] A look at the media art festival *Ars Electronica*'s program from the past years shows a high percentage of Japanese art projects. The same is the case for the annual computer graphics conference SIGGRAPH. Events like the exhibition organized by the Japan Media Arts Festival at MuseumsQuartier in Vienna in September 2009 are examples of a palpable Japanese presence in this field.

In the following, I will refrain from adding the adjective 'new' to media art. In various publications it has been introduced in order to distinguish more recent forms of media art, like interactive installations and Augmented Reality systems from early media art, e.g. experiments in electronic music or by now established video art. From now on, I refer to *new* media art omitting the 'new'.

through 18th century Japanese culture".[30] Yet the current institutional setting of media art crystallized only in the late 1980s. This is when various efforts were undertaken to provide a supporting structure to the emerging electronic arts. In 1990, the Tokyo Metropolitan Museum of Photography opens at a temporary location and displays some media art exhibits.[31] That same year, the Japanese telecommunications company NTT launches its own media art center, which finds its physical realization only seven years later with the opening of the NTT InterCommunicationsCenter in Hatsudai, Tokyo. Also in 1990, the Canon ARTLAB is established, strongly promoted by Canon Inc.'s CEO at that time, who is deeply interested in the historical art/technology relationship and is seeking to promote artistic efforts at the borderline to cutting-edge computer technology of the early 1990s.[32] Both, the NTT ICC and Canon ARTLAB, open their first exhibition in 1991.[33] In the early days of media art institutionalization in Japan, its major promotion thus comes from the industry.[34]

The 1990s, the boom years of media art promotion, also saw the creation of the "L'ORÉAL Art & Science of Color Prize" in 1997, a prize "given to artists and scientists in recognition for their works achieved on the theme of color, the veritable link between Art and Science".[35] It is another example of the industry's involvement in fostering the media arts in Japan even though (just like the Canon ARTLAB which stopped its activities in 2001 due to lacking support by the company's changed leading infrastructure) the L'ORÉAL prize was awarded for the last time in 2006.

Remarkable is not only the importance of Japanese companies promoting the electronic arts. Other main sources for their funding are provided by institutions like

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[30] Machiko Kusahara, "Considering media arts through 18th century Japanese culture", in: *Japan Media Arts Festival in Vienna 2009*, exh. cat., MuseumsQuartier Wien (Vienna 2009), p. 8-9.

[31] It moved to its current location in the Yebisu Garden Place in 1995 and hosts an 'Images & Technology Gallery' which frequently shows works of media art, video game culture, and the like.

[32] Yukiko Shikata (senior curator at NTT ICC, formerly curator at Canon ARTLAB) talking about the former CEO Keizo Yamaji; in an interview with the author, at NTT ICC, July 22, 2009.

[33] In the case of the ICC, its first exhibition "The Museum Inside the Telephone Network" took place within an experimental framework as an on-phone / proto on-line exhibition.

[34] This especially, since media art can be considered rather a side branch of the Tokyo Metropolitan Museum of Photography's core interests, reflected in the fact that exhibitions of electronic arts are taking place only now and then. In Europe on the contrary, efforts to institutionalize the media arts were and are to a much greater extent state-subsidized through cultural funds, like the Ars Electronica project, launched in 1979, opening its physical center in 1996, or the ZKM in Karlsruhe (opened in 1997 with due set-up time, starting as early as in the mid-1980s).

[35] www.loreal.com/_en/_ww/loreal-art-science/loreala_sofcolor.aspx. The prize, however, was not strictly limited to 'media art' nor was it limited to Japanese art.

the state-run Japan Science and Technology Agency (JST) or the Agency for Cultural Affairs. JST is *the* agency fostering technological innovation in Japan and is strongly involved in the promotion of public understanding of science and technology. As such, it is the funding body of Tokyo's new science museum Miraikan – the National Museum of Emerging Science and Innovation, opened in July 2001. The link between technology and art becomes evident in Miraikan's special section devoted to new media, the Laboratory for New Media. In this part of the museum, media artists and engineers display their newest 'research' in interface design, gadgetry, and artistic approaches. JST also initiated a program called 'Core Research of Evolutional Science & Technology', in short CREST. "CREST is one of JST's major undertakings for stimulating achievement in fundamental science fields. In addition, returning the fruits of such researches to the society through innovations is another important responsibility of JST."[36] Within the framework of this research funding, JST has been supporting several five-year projects at the borderline between engineering department and artistic approaches. One of them, 'Creating 21st Century Art form Based on Digital Media', is led by the renowned media artist Masaki Fujihata, professor for new media at Tokyo Geijutsu Daigaku, Tokyo's biggest art university. It is seeking to develop digital tools for traditional artistic expression, for example digital painting and drawing tools. Another one, which will be of interest later on in this chapter, is a project running under the title 'Expressive Science and Technology for Device Art'. Hiroo Iwata, professor at the Institute of Engineering Mechanics and Systems of the University of Tsukuba, is the head of its research team consisting of engineers, media art scholars, and artists. Through the CREST-funding, JST is providing financial support to projects linking media art and technological innovation. In Japan, where government support for contemporary art is perceived as being meager and in no way comparable to subsidies offered in many European countries, this source of income for artistic projects – be it through the possibility of exhibiting in *the* science museum in Japan, Miraikan, be it through direct support for artistic projects in the case of CREST-funds – is quite an important revenue for individuals engaged in one way or another in the artistic field.

The Agency for Cultural Affairs, which just like JST is a subdivision of the Ministry of Education, Culture, Sports, Science and Technology (MEXT), initiated the annual

[36] www.jst.go.jp/kisoken/crest/en/about/index.html.

Japan Media Arts Festival in 1997 and has been supporting it financially ever since. The festival is the biggest and most important festival of its kind in Japan with a total of 2,592 works submitted for its 13th edition in the year 2009, 673 of which came from abroad.[37] One notable reason for the fact that over 74% of the works submitted for this 'international media arts festival' are created by Japanese applicants can be found in the organizational structure of the festival. It is divided into four divisions: Art Division, Entertainment Division, Animation Division, and Manga Division. In the international media art context, this structure might evoke surprise – animation, but certainly entertainment and manga, are not necessarily a constitutive part of and never to such a big extent represented in media art festivals elsewhere.[38] With its differences from the 'Western'-dominated international art scene, the Japanese Media Arts Festival shows certain clues for a specifically 'Japanese' way of setting up such an event.

Along with the industry's and technology agencies' funding, a third column of support to the media arts in Japan comes from science and engineering departments of various universities. Internationally, efforts by institutions like the Massachusetts Institute of Technology (MIT) with its Media Lab founded in 1985 have shown that research departments of universities have a growing interest in fostering creative approaches. However, MIT's Media Lab or the University of Western Australia with its SymbioticA (established in 2000 as a laboratory within the School of Anatomy and Human Biology) are rather exceptional in their respective national context and also internationally. In Japan, there has been quite an increase in any kind of support for creative approaches in science and engineering departments in recent years. Be it the inauguration of institutions like the Graduate School of Interdisciplinary Information Studies by the Interfaculty Initiative in Information Studies (III) at the University of Tokyo (Todai) in the year 2000, be it sub-departments like the 'Multimedia Science and Arts Area' at the Graduate School of Global Information and Telecommunication Studies at Waseda University in Tokyo which aims at conducting "research into cyber-

[37] plaza.bunka.go.jp/english/festival/about/.

[38] In the past years, however, even *Ars Electronica* has included a permanent 'Animation Festival' within its festival. From its first awarding on, the category "Computer Animation / Film / VFX" has been one of the categories of *Prix Ars Electronica*. Interestingly, in all the years from 1987 to 2009, there has not been one Japanese awardee for this category. Likewise, in the Japan Media Arts Festival's Animation Division, contributions and awardees are by the majority Japanese.

space representations, image processing, multimedia representation, human communication, audio language information processing, acoustic information processing, media design and media art from the viewpoint of engineering and art targeting multimedia"[39] – such enterprises seem to be springing up like mushrooms in academia and are always focused on technological development. "The III is a truly inclusive and integrative interdisciplinary organization drawing together fields on either side of the traditional divide between the 'Sciences' (mathematical and natural sciences) and the 'Arts' (social sciences and the humanities)."[40] This statement on the fundamental incentives for newly established academic programs is representative of prevalent post-Snow rhetorics on the bridging of disciplinary gaps, and also of the general idea behind the scene: the hope for benefits in novel technology research by overcoming conventional institutional divides.

"As the consequence of the ever-rising dependence on information science and technology in contemporary society, industry and personal life, it is required to provide and deepen their foundations and to create new ideas. It will be vital for the society to furnish means of effectively configuring the advanced and intelligent information systems that function as the nerve and brain systems of the society. To address these needs, the Graduate School of Information Science and Technology [at the University of Tokyo] was established in April 2001."[41] Not only interdisciplinary startups like the III or the Graduate School of Information Science and Technology, but also 'traditional' institutions like the Graduate School of Engineering at Todai are in one way or the other supportive of new and more open approaches. The School of Engineering was in principle founded in 1886, with the establishment of Tokyo's Imperial University. Today, students of its graduate courses in engineering are highly encouraged to take part in creative research, in displaying it at forums beyond traditional academia, and in fostering interdisciplinary skills. The three departments presented their research at Ars Electronica festival in 2008 within the framework of 'Campus 2008 – Hybrid Ego'. Rhetorics of unison can also be found in the message of Todai's president Hiroshi Komiyama, composed for this occasion: "It is necessary to integrate the knowledge that has been fractionalized into numerous specialized fields into one unit, associate pieces of knowledge with each other, and apply the

[39] www.giti.waseda.ac.jp/GITS/index_en.php?href=02faculty/en_area02.html.

[40] www.iii.u-tokyo.ac.jp/english/about/index.html.

[41] www.i.u-tokyo.ac.jp/edu/stud/idea_e.shtml.

significance of such cutting-edge studies to society […]. Undoubtedly, the perspectives of international exchange and artistic activity, in addition to studies in laboratories and schools, can be effectively used to carry out the structuring of knowledge."[42] In order to 'structure knowledge', the sharpening of creative skills in engineering departments is perceived as innovative and progressive, leading to technology and the arts being more perfectly integrated into society. It is this idea that lies behind the University of Tokyo's presence at Ars Electronica 2008, with research teams presenting their novelties in interface design, robotics, mixed reality systems, and other research areas.

To illuminate the institutional aspects of Japanese engineering departments' entanglement in artistic creation and "how the engineering students became interested in making some artistic contents", I will cite a longer passage from an interview with Machiko Kusahara, who has already been mentioned above as one of the most eminent media art scholars in Japan and who is professor of art theory at the School of Letters, Arts and Sciences at Waseda University, Tokyo. She is alluding to a student competition organized by the Virtual Reality Society of Japan (VRSJ). VRSJ was called into being in 1996 by several professors and researchers at universities and national institutes, mostly from an engineering or information studies background. The objectives of VRSJ are stated in very much the same tenor as Komiyama's address, referring to the growing importance of technology and specifically virtual reality systems in nowadays' society.[43] The student competition 'Inter-College Virtual Reality Contest' (IVRC), which started already three years earlier, in 1993, "has become an important meeting place for art and engineering students" in recent years, claims Machiko Kusahara.[44]

> [About VRSJ, IVRC, and collaborative projects between the engineering and the art field:] This is a conscious effort of people involved. It already started with IAMAS [International Academy of Media Arts and Sciences, established in 1996 in Ogaki City], which was founded by Itsuo Sakane. Many things happened around those people, the professors, researchers from the Virtual Reality Society of Japan, VRSJ – professor Tachi, Harashima, Naemura, and others… And for the Japan Media Arts Festival the input from those people has been very important. It didn't just happen naturally. [It was]

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[42] *Campus 2008. Hybrid Ego. The University of Tokyo*, exh. brochure, Ars Electronica festival 2008, no pag.

[43] Cf. VRSJ's intended purpose on www.vrsj.org/main.html.

[44] Machiko Kusahara, "Device Art. A New Form of Media Art from a Japanese Perspective", *intelligent agent* 6 (2006), No. 2, online source: www.intelligentagent.com/archive/Vol6_No2_pacific_rim_kusahara.htm.

> various individuals who knew each other. So what is the strength here is that there is a network of people in this field. It is a very close network – everyone knows each other… from art, from science, from engineering, from media. And I think this collaboration has taken place for many years.
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> […] Earlier, the talk was: so, using this technology we can do this or that. Now these days, they start with… for example: how about when you're walking in the street and you find something?… what do you find? That kind of thinking – they start with artistic approach[es]. It has very much changed. In the country there are maybe twenty different labs at universities from which those submissions [at IVRC] always come. They know from earlier that this kind of conceptual approach would work better and they have more chances to bring their works to SIGGRAPH or Ars Electronica. This competition, I think, really changed the way in which engineering students do their own work. It is also very good because usually, normally, in Japanese engineering departments, in the old style, students are kind of told by their professors, doctorate candidates, for example: 'So, this is the thing. You do this. You do this sensor. You do this program…!' It was like this in Kobe where I used to teach. But with this competition, students can bring up their own ideas. Usually there are several themes, topics, from one lab. And if someone's idea wins, then all other students collaborate. So it is a very good chance for the students to try their ideas. Because once they are selected, they will get the full support from their colleagues and professors. […] It is really about the network and the personalities. When it comes to engineering, especially when it comes to the human interface, virtual reality kind of things, we have several people, leading people in the field who seriously try to make this network and appreciate the art and who know the importance.[45]

Kusahara's words illustrate nicely how initiatives like the above-mentioned have come into being in recent years. Not unlike other sources of support for the media arts, through the industry or governmental agencies, encouragement for artistic ventures in the academic engineering field crystallized the mid-1990s. It was the joint effort of several individuals in different engineering departments in Tokyo and other academic centers in the country that brought about an infrastructure reflected in the establishment of the Virtual Reality Society which is still very active in promoting creative access to technological matters of research. Student competitions like the IVRC are an excellent platform for young researchers to come up with and present their innovations to an interested audience. As states Kusahara, this national platfrom

[45] Machiko Kusahara in an interview with the author, Toyama Campus, Waseda University, Tokyo, July 29, 2009.

is perceived as a major springboard to enter the international scene of cross-disciplinary research.[46]

The supportive structure of a field, its financial sources, and patronizing institutions are always meaningful with respect to the freedom of action of its 'players'. The cultural sociologist Stephan Fuchs has shown how the observation of social structures in any field of culture can give valuable insights into its very functioning and its constraints, how it can unveil hidden dependencies.[47] In taking a sociological stance looking at the media art scene in Japan, specifically in Tokyo, I hope to find expedient explanations for the rhetorics employed by its actors and offer a better understanding of how art positions itself in a society in which technology could hardly be of higher significance. In order to shed light on institutional entanglements and the regulatory framework affecting media artists, scholars, and individuals from the engineering field alike, I deem it useful to examplify the specific set-up in a case study of a certain type of media art currently strongly promoted in Japan: so-called Device Art. In doing so, I hope to illuminate working networks, coherences and incoherences, boundaries and subcultures in a field of cultural production. A helpful source of orientation for my analysis has been Andrea Glauser's monograph on international artists-in-residence programs. Glauser bases her observations on Pierre Bourdieu and aligns her approach with delimiting terms like 'symbolic economy', 'field of positionings', and the concept of habitus.[48]

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[46] I have not done any research on third-party funds in science and technology departments in Japan and specifically Tokyo. Taking into consideration these funds, another picture might ultimately be painted by a yet higher percentage of industry funding in the scene.

[47] Cf. Stephan Fuchs, *Against Essentialism. A Theory of Culture and Society* (Cambridge MA and London 2001), p. 167.

[48] Andrea Glauser, *Verordnete Entgrenzung. Kulturpolitik, Artist-in-Residence-Programme und die Praxis der Kunst* (Bielefeld 2009), esp. p. 20-27. Like for Glauser's research, interviews with various actors in the field – with artists, curators, engineers – will be of central significance for my study. At times, I will not refrain from citing longer passages for the benefit of longer insights into the actors' voices. All interviews have been recorded and transcribed. I have left them unedited except for indicated omissions and minor linguistic corrections.

2. Device Art – A Very Japanese Media Art

In an interview in 2005, media artist Ryota Kuwakubo brought up the label 'device artist'. To him there were two types of media art – the one taking on an 'advanced technology' perspective and the one that was more concerned with existing technology and 'misusing' it in a new way – and he allocated himself in the latter field.[49] He further explained that he had once called himself a 'device artist', and went on: "…[b]ut I would like to stress the meaning of things and their workings [not the object itself]". That is why he reacted to the 'European critique' of his and Maywa Denki's art as being mere 'gadgets' and to the questioning of their art status. "Personally I believe it's important for things to have a user-friendly, fun form that will make lots of people feel comfortable with them. Undoubtedly though, it's difficult to send a strong message to a lot of people." He no longer insisted on the term provoking so much confusion on the international level.[50] In the summer of 2009, visitors of Tokyo's biggest science museum Miraikan witnessed "Ryota Kuwakubo: The Smiley Transisters" [sic] on entering the museum's newly installed Laboratory for New Media – the fourth exhibition on display in this section. According to the exhibition text, Kuwakubo's artworks were representative of 'Device Art' and were combining cutting-edge technology with traditional Japanese culture, linking art and functionality. Little later that year, the annual Ars Electronica festival in Linz displayed various Japanese media artworks. In the section labeled 'Artists, Creators, Engineers', Ryota Kuwakubo, Maywa Denki, Hiroo Iwata, and others, presented their art as 'Device Art'. Along with the exhibits, a symposium and several artist talks had been organized.[51]

Works

What exactly is Device Art? What kind of media art and what kind of theoretical foundations are grouped around this term?

Kuwakubo has been represented with his works *Nicodama* (2009), *loopScape* (2003) or *PLX* (2001). *Nicodama* is a device that looks like a toy eyeball and is equipped with an infrared transceiver and a magnetic mechanism. Attaching two of these eyeballs next to each other on any surface, any object, triggers a mechanism of synchronized

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[49] Tetsuya Ozaki, "Ryota Kuwakubo in Interview", in: *ART iT*, Winter/Spring 2005, Vol. 3, No. 1, 64-67, p. 66.

[50] Ibid., p. 67.

[51] The 'Device Art Exhibition' in the center was on permanent display until February 28, 2010.

blinking. According to the official text accompanying the work, it thus "allows us a totally new, emotional view on our environment and the objects that surround us."[52] Both, *loopScape* and *PLX* are games for two players. The former is a video shooting game played on a cylindrically shaped screen, on which the bullets shot of by the players threaten their creators themselves, if they miss their target and come flying around the screen from behind. *PLX* in turn is a game console allowing two players facing each other with different screens find out that they are actually playing the same game, not a different one as suggested by the game set up. "It is a work that expresses the communication gap and the miscommunication between people who think they are seeing something different from what the other is seeing."[53] In 1998, Kuwakubo created *BitMan*, a simple device with an animated man on its little LED-display. *BitMan* was finally mass produced into a shaker device with the little man dancing, more and more energetically, the more you shake the device, thus evolving from a prototype artwork to a multiple and eventually a marketable product in 2001. The product version was co-produced by Maywa Denki.

Maywa Denki is a pseudonym under which Nobumichi Tosa is running his 'company' producing 'nonsense machines'. Those 'machines' are any kind of electronic devices Tosa builds and which he uses in his performances that might be situated somewhere between slapstick and concerts of electronic music. In these performances – called 'product demonstrations' – Tosa and his assistants wear blue workers overalls, referring to Japanese electricians' outfit as well as to the 'product' status of his electronic artworks, which can be, but are not always mass-produced. The already-mentioned *BitMan* is still on the market and can be purchased directly on Maywa Denki's homepage. In 2003, Tosa won the Ars Electronica distinction award with his *Tsukuba Series*. The series' name reflects the link of Maywa Denki's art and Japan's techno-scientific development. Tsukuba is the name of Japan's 'Science City', situated about an hour north of Tokyo. It was constructed in the 1960s, planned specifically in order to foster scientific research in Japan, built around the University of Tsukuba and a large number of independent research institutes. Naming his series of musical instruments after this place, Tosa ironically hints at their status as being intrinsically linked to the years of Japanese technological leadership. Ironical is the fact that the *Tsukuba* instruments are simple electronical items "played by the

[52] *Device Art @ Ars Electronica 2009*, exhibition flyer, Ars Electronica Center, 2009.

[53] www.miraikan.jst.go.jp/en/info/090519173300.html.

movement of motors and / or electromagnets at 100V and make […] a sound by practically beating/knocking a substance".[54] The acoustic instruments that issue sound through integrated speakers have uniquely been used in Maywa Denki's performances and have so far not been mass-produced unlike others of his devices. At the Ars Electronica festival in September 2009, Tosa presented his *Knock! Music Program*. In the live-shows at his stand, he demonstrated his installation of knocking devices that followed a programmed automatism and played the instruments at hand, always true to his characteristic ironical performance style. Conceptually, the *Knock Program* is linked to his *Knockman Series*, a series of commercial products brought on the market in 2003. The series consists of a number of single small devices that make sounds by knocking onto or by strumming strings attached to their own chassis. Also at Ars Electronica 2009, Tosa for example performed on his then newest item, the *Otamatone*. Little later, the instrument was already advertised on his official website, with the sales starting in November of that year. *Otamatone* is a saxophone-shaped plastic instrument, 27 cm tall, and battery-powered. By sliding your finger up and down a tactile interface, you can play simple tunes, regulating the volume or intensity of the sound by squeezing the item's 'mouth'.

Not all of the works presented under the label 'Device Art' are hand-held devices or game consoles. One of the leading 'players' in the Device Art field is Hiroo Iwata – engineer and professor at Tsukuba University. Already in 2006, shortly after the coining of the term 'Device Art', Iwata and other artists and engineers participated at the Inter-Society for Electronic Arts' (ISEA) biennial meeting in San Jose, USA. Also that same year, they exhibited various of their works as 'Device Art' under the category of emerging technologies at the SIGGRAPH convention in Boston. Iwata, who has been present on the international stage at fora like SIGGRAPH or Ars Electronica since 1994 and who has won honorary mentions at the prix Ars Electronica in 1996 and 2001, has been using these platforms in order to advertise his latest research. Be it simulations of out-of-body visions like in his project *Floating Eye* developed in 2000, be it his *Robot Tile* from 2007, Iwata has ongoingly presented his interface research, in the past years under the label of Device Art. *Robot Tile* for example is a locomotion device that enables a "sense of walking while the position is

[54] See Maywa Denki's homepage at www.maywadenki.com/concepts/what_tsukuba.html.

maintained in the real world"[55] and has been exhibited internationally. It is part of basic motion research potentially applicable in various fields. In early 2009, Iwata had a solo exhibition at Miraikan science museum in Tokyo, entitled "Hiroo Iwata: Dr. Strange Device". Later that year, he was part of the group of Japanese artists and engineers displaying their work at Ars Electronica Center in Linz.

His newest work *Media Vehicle* developed that same year is "a mode of transportation for moving simultaneously around real and virtual worlds. The *Media Vehicle* provides the rider with complex and unique experiences through the combination of wide-angle live-video images and real movements. The rider experiences being moved around like a puppet by someone else outside the vehicle."[56] The *Media Vehicle* offers an experience similar to that of a flight simulator with the specificity to feel exposed to an outside control while being locked into an inner shell. Remarkable about the vehicle is certainly rather the complex technology behind it than the actual experience one has when seated inside the 'art object'. Unlike the works by artists like Kuwakubo or Maywa Denki, it is solely a prototype research project of some two meters' height and was altered and improved between the Miraikan and the Ars Electronica exhibition, revealing its research project status.

Apart from Kuwakubo, Tosa and Iwata, there have been a number of other artists grouped under the term Device Art – Sachiko Kodama with her *MorphoTower* series of 2003-2009, Kazuhiko Hachiya with *Fairy Finder*, and Masahiko Inami and his optical camouflage design or in 2009 with *Surrounding of Firefly,* among others.

Device Art thus encompasses a broad spectrum of objects, works of art, research in the engineering sciences, gadgets, game consoles, and interface design. It describes prototype artworks and research outcomes as well as mass-produced toy series like the ones by Maywa Denki. It is this conceptual disparity that renders Device Art interesting to the analyzing eye. It functions as an umbrella term for various artistic and scientific approaches in a field between art and technological development, a label actively promoted by certain protagonists, players who draw benefit from its dissemination. The disparity of objects that are presented as Device Art raises the question of the term's conceptual foundation and of the discursive framework that comes along with it. It also renders necessary a critical reflection of the term 'art'

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[55] *Device Art. Summer 2006*, exh. brochure, SIGGRAPH and ISEA 2006, no pag.

[56] *Device Art @ Ars Electronica 2009*, exhibition flyer, Ars Electronica Center, 2009.

employed here and of its significance in the Japanese context. Perceiving the artists, theoreticians, and engineers, in the field as actors in a network, one obtains an idea of how artistic promotion, technological development and the hunt for funding in both fields are intrinsically linked and how self-positioning can be of vital significance concerning not only fund-raising but also public visibility.

Players and Networks

Hiroo Iwata is, along with the art theoretician Machiko Kusahara, one of the driving forces of the label Device Art. He is also the main promoter and Research Director of the above-mentioned CREST-funded Device Art project 'Expressive Science and Technology for Device Art'. Hiroshi Harashima, now retired professor of the III at the University of Tokyo and longtime president of VRSJ entered the project in 2005 as its Research Supervisor. As such, he functioned from 2004 onwards in the overall research area 'Foundation of Technology Supporting the Creation of Digital Media Contents', a CREST-funded framework for the Information Sciences strategically promoting the development of advanced technology in this field with the help of more creative approaches.[57] The 'Device Art project' presents itself on a JST-related website:

> Device art is composed of interactive work that expresses essence of mechanical and digital technologies. This project has two goals; (1) systematizing technologies used in device art and (2) studying methodologies in creation and evaluation of device art. In order to achieve the goals, a new facility named "Gadgetrium" is planned to establish [sic]. It is a combination of research laboratory, exhibition space, and venture business. This project contributes to manufacturing industry by commercializing the art work.[58]

In an interview with the author, Hiroo Iwata explains that the purpose of the project is to establish a video archive of interviews with device artists, systematize it and put it online for public access. The database is meant to enable artists to refer to their interviews very much in the same way as researchers would mention scientific papers as references. The art theoretician Machiko Kusahara is the person in charge of

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[57] On their official website, JST talk about "stategic sectors" and specifically mention envisioned aims of the initiated research programs: www.jst.go.jp/kisoken/crest/en/category/area04-7.html. Put a bit awkwardly, the 'Strategic Sector' "Creation of an Advanced Science and Technology which Supports the Raising of the Level of Creation of Media Art" conveys an idea of how development in information technology, fostering creative approaches, and the multiple use of digital media, are conceptually interwoven in this framework and how the word 'art' or 'media art' have a distinct connotation in this context.

[58] www.media.jst.go.jp/english/scholar/c17/05iwata.html.

evaluating the interviews.[59] She is also responsible for a number of articles on Device Art and main curator of several of the exhibitions. From the beginning on, she is mentioned along with the artists and engineers active in Device Art. The official website deviceart.org enumerates the collaborators of the project in alphabetical order: Hideyuki Ando, Masahiko Inami, Hiroo Iwata, Machiko Kusahara, Ryota Kuwakubo, Sachiko Kodama, Nobumichi Tosa, Kazuhiko Hachiya, Taro Maeda, and Hiroaki Yano. It is the same group of people signing the Device Art brochure of 2006's ISEA and SIGGRAPH conventions. It is also this group of people that has set up the Device Art exhibition at Ars Electronica festival in 2009.

What is the significance of a rather small group of engineers, artists, and one art theoretician gathering around one umbrella term – a term with which it positions itself in a national and international media art context? By studying the underlying network structure of the actors in the field, I regard the Device Art model illustrative of general given factors in the Japanese media art scene. Device Art can function as a lesson toward a deepened understanding of media art's position in Japan specifically, and generally of the electronic arts in a societal setting between technological progress and the gallery space.

The importance of individuals and their actions in those networks is one aspect which has been assessed in this study. The evident influence exerted by individuals in the set up of the Japanese media art scene as it is today has been underlined by various people[60] and is exemplified already around 1990 in the figure of Canon Inc.'s CEO. In an interview, Yukiko Shikata, senior curator at NTT InterCommunicationCenter (ICC) until 2010 and formerly joint-curator at Canon Inc.'s ARTLAB (from its beginnings in 1990 until its closure in 2001), stresses the importance of Canon Inc.'s CEO "at that time", when the ARTLAB was called into being.

> (…) he was very interested in Leonardo da Vinci, in the combination of art and technology. He came out of the engineering speciality, but he was very interested in art and technology issues. Then there was some producer who conceived this idea and asked me and another person, Kazunao Abe, he is now currently artistic director and chief

[59] Iwata in an interview with the author, Graduate School of Systems and Information Engineering, University of Tsukuba, July 30, 2009.

[60] Even Kusahara and Iwata themselves stress the importance of networks in interviews with the author.

> curator at Yamaguchi Center for Arts and Media (YCAM), so we cooperated in all those things.[61]

Reasons beyond personal interest for the establishment of Canon ARTLAB can undoubtedly be found in the historical situation. The time was ripe for media artistic promotion as well as for the industry's realization of its creative potential. As states Dieter Daniels in 1992, the meager presence of culture in commercial Japan, along with the weak status of media art, was being tackled by projects like the newly inaugurated ARTLAB.[62] Canon's big overseas competitor, Xerox, was launching its Xerox PARC artists-in-residence program (PAIR) only little later (it was in its planning stage in the early nineties and was opened officially in 1993) which indicates the rising significance of creative resources in the companies' vision in the early 1990s.[63] In any case, the institution of Canon ARTLAB was strongly promoted by certain individuals, just as its closure was a consequence of a change in Canon's leading structure.

> When the new CEO came in 1994, he put a lot of stress on us already, but we could continue because we got some very important prize for our products, so he could not ask us to stop easily. But finally, in 2001, we had to stop.[64]

The interests and personal tastes of individuals in company structures and in funding institutions are reflected in Canon's establishment and ten-year promotion of the ARTLAB, but also in its shutdown. Other media art institutions in Japan have been fostered by similar individual commitment. It is through tightly knit networks that the scene developed into its current state.

Engineering professors Harashima and Iwata, both founding members of the Virtual Reality Society of Japan, cooperate in research projects fostering the media arts.

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[61] Yukiko Shikata in an interview with the author, at NTT ICC, July 22, 2009.

[62] "Zwar kündigt sich an, daß in der Medienindustrie in Japan die Zeiten der rein produktorientierten Gewinnmaximierung vorbei sind und die Bedeutung eines kulturellen Image erkannt wird. Zum Beispiel leistet sich Canon den Luxus eines mit sehr dezentem Sponsorship eingerichteten ‚Art Lab' (...)." Dieter Daniels, "Der elektronische Horizont. Randbemerkungen zum Video & Television Festival, Tokyo 1992", in: *Mediagramm. Zeitung des Zentrums für Kunst und Medientechnologie Karlsruhe*, No. 7, March 1992, 3-5, p. 4. For an overview over inauguration and maintenance of Canon ARTLAB from a company-internal perspective, see also Canon Inc. ed., *Partner of Forerunners. Canon's Cultural Support Activities* (Tokyo 2000).

[63] Cf. Craig Harris ed., *Art and Innovation. The Xerox PARC Artist-in-Residence Program* (Cambridge MA and London 1999). In his article in this publication, Craig Harris nicely underlines the importance of forerunners in art/science collaboration from the 1960s onward, like E.A.T., the Bell Labs in Murray Hill, or Ars Electronica and ZKM, ibid. p. 2-11.

[64] Yukiko Shikata in an interview with the author, at NTT ICC, July 22, 2009. Actually, Canon's president Keizo Yamaji was followed by Hajime Mitarai in 1993, who was in turn replaced by Fujio Mitarai in 1995, still CEO and president of Canon Inc.

Kusahara, a member of VRSJ from its beginning onward, collaborates in the CREST project, is offered a platform to curate exhibitions nationally and internationally, publish articles on Device Art, and become a representative of a "new form of art"[65] as its background theoretician. Artists like Kuwakubo and 'art unit' president Tosa, as well as researchers like Hideyuki Ando and Taro Maeda, join the CREST project and exhibit their art, commercial products, and research. It is the network that enables the activities planned and the links to exhibition spaces like the science museum Miraikan. Forming a group and appearing as such under the label Device Art not only grants the advantage of cumulated effort in organizational matters – it also allows the Device Art project members to perform internationally within a stronger framework. This framework is promoted twofold by JST: through the CREST funds, but also through the permanent exhibition space granted in Miraikan.

The 'Gadgetrium' which is mentioned in Device Art objectives[66] is part of the CREST project's aims:

> In order to achieve this goal [i. e. the 'systematization' and 'evaluation' of Device Art], a new framework named 'Gadgetrium', which is composed of a laboratory, exhibition room, and venture business, was constructed. In 2008, we opened the permanent exhibition space, 'Device Art Gallery', in the National Museum of Emerging Science and Innovation (Miraikan) in Tokyo. We believe technology will advance and be refined with help from audience feedback and participation.[67]

Asked about the Gadgetrium and its conception, Iwata explains that exhibitions like the ones in Miraikan or the (then still) upcoming exhibition of Device Art at the Ars Electronica Center in Linz are part of this vessel.[68] The above-mentioned commercialization of the artwork and the project's wish to "contribute[…] to [the] manufacturing industry" is visualized in an illustration of Gadgetrium's functioning on the official Device Art website as well as in brochures like the one produced for the Ars Electronica festival in 2009. Here, the essence of the Gadgetrium is presented schematically: it consists I) of the permanent exhibition space in the science museum Miraikan, II) of a "Laboratory" where the technology is "systematized" and "methodologies in creation and evaluation" are elaborated (that is, the activities

[65] www.deviceart.org.

[66] Cf. footnote 58.

[67] www.deviceart.org.

[68] Hiroo Iwata in an interview with the author, Graduate School of Systems and Information Engineering, University of Tsukuba, July 30, 2009.

concerning the video database Iwata talks about), and III) of a "Venture Business (Commercialization of artworks)". This aspect of "commercialization" is not more closely specified. It is, however, mentioned in statements and texts as a constitutive part of Device Art:

> Playfulness contributes in bringing art outside of museums and galleries, enabling even commercial production and distribution of artwork to reach a wider public. Hachiya, Kuwakubo and Tosa have commercialized their works to be integrated in our daily life. Device Art rejects the traditional idea that draws a line between art and commercial products.
>
> Mitate, the tradition of using metaphors, associations and double meanings in a playful manner often works together with playfulness. Mitate means seeing beyond the actuality.[69]

Commercialization is not usually a characteristic intrinsically linked to art forms, at least not as outspokenly as it is in the Device Art concept. However, Device Art obviously takes up the idea of the 'multiple' with its heyday in the 1960s. The manual or industrial reproduction of an artwork conserving its status of an *original* is well known from artists like Daniel Spoerri, the Fluxus group, or of course Andy Warhol.[70] Even though by far not all artworks of Device Art have been multiplied or even mass-produced to be sold via the Internet, they relate to the tradition of the 'multiple' after the 1960s on the one hand and to products like the 1990s' *Tamagotchi*[71] on the other hand. They also correlate with media artist Toshio Iwai's *tenori-on*, a digital musical console co-produced with Yamaha in 2007. The *tenori-on* is a good example of how an artistic impetus is turned into a product and becomes independent of the art context that it leaves behind.[72] In the field of Device Art, calls for a 'democratization' of the artwork and commercial interests go hand in hand. It oscillates between the two poles by seeking inclusion in art festivals as well as fostering the industrializability of the art piece.

At the same time, the commercial aspect of Device Art is rhetorically linked to 'traditional Japanese' art and culture. In all of the texts describing Device Art, this

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[69] Machiko Kusahara, "Why Device?", on: intron.kz.tsukuba.ac.jp/vrlab_web/why.php.

[70] For an overview of the emergence of the 'multiple' see e. g. Katerina Vatsella, "Produkt: Multiple! Zur Entstehung einer Kunstform", in: Neues Museum Weserburg Bremen, ed., *Produkt: Kunst! Wo bleibt das Original*, exh. cat. (Bremen 1997), 57-64.

[71] The Tamagotchi is a little 'digital pet' sold by Bandai Ltd. since 1996. *BitMan*'s similarity to the handheld device is striking.

[72] Even though he neatly seems to fit into Device Art's premises, Toshio Iwai is not part of the Device Art group which might be explained by his ongoing (commercial) success.

aspect is mentioned as one of the essential traces of the art form. 'Mitate', a term dating back to Japan's Edo period (beginning in the 17th century), is a concept encompassing literature, the art of tea ceremony, and also the viewing of woodblock prints.[73] The bridge between 21st-century Device Art – an electronic art form – and 'mitate', an Edo period method of enjoying artistic artifacts, may not be obvious at first sight.

3. Japaneseness Sells

What do engineering departments fostering creative approaches and exhibiting research at art festivals on the one hand have to do with the coining of the term 'Device Art' by curators and researchers on the other hand? What is the significance of commercialization and traditional Japanese culture in the rhetorics around this "new form of art"? Possible answers can be found in the importance of Japan's so-called 'soft power', its notion of 'cultural exports', and its 'content industry'.

> To create a certain structure for media art to get some support from the government, from the industry or whatever, at least in Japan, you still have to explain it in such a manner that they [i. e. the funding institutions] understand. That there is some merit for them…[which] they have to see, not after a hundred years, but maybe after ten years. You have to show the relevance. When it comes to the collaboration between art and engineering, it is understood that artists have crazy ideas, so maybe there can be something they [the engineers] can learn from them or pick up. When it comes to the governmental support, we are always having these two different approaches. One is that for culture issues you have to really take time. So they shouldn't expect that they will have a lot of export in three years, it's impossible. On the other hand, one has to explain that art wouldn't produce sort of a direct outcome immediately. You have to kind of logically state why the state has to support it.[74]

In circumstances not all too favorable for cultural funding, the endeavor to get financial support becomes adapted to what the funding institutions like to see presented as a possible outcome. As states Kusahara herself, it is evident that rhetorics in the promotion of art forms like Device Art are intrinsically linked to the wish to be

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[73] *Mitate* is often employed with the intention of provoking a humorous response: Thomson 1986, "[…] the notion of *mitate*, literally meaning 'comparison' but translatable as 'parody' or 'analogue'. The essence of *mitate* is an amusing juxtaposition of two unlike ideas – for instance, a selection of beautiful women compared with noted scenic spots in Edo […].", p. 22.

[74] Machiko Kusahara in an interview with the author, Toyama Campus, Waseda University, Tokyo, July 29, 2009.

funded and thus serve the best possible way to fulfill the funding situation's requirements.

In Japan, one of these requirements is the commercializability of the media art work. Kusahara is not the only one to refer to the necessity to 'sell' the idea of media art. In one way or the other, several individuals involved in the field stress this aspect, whether critically like Masaki Fujihata of the Tokyo University of the Arts or NTT-researcher Junji Watanabe. Many scholars of popular culture have highlighted the importance of Japan's so-called 'content industry' lately. Be it in governmental white papers, technology agencies' objectives, or in news reports, the aim to strengthen the Japanese industry around telecommunication, computers, and their 'contents' is omnipresent. The *White Paper on Science and Technology 2004*, issued by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in April 2005, mentions that "culture and the arts are resources for the realization of high-quality economic activities. The market for digital content of culture and art is estimated to exceed 2 trillion yen, marking the sector's importance as a national industry for Japan."[75] With an eye on these data, the promotion and strategic consolidation of the content sector – computer technologies in general, video games, manga or anime more specifically – become a major task for the entities involved in the field. It is the overall realization of the sector's presumed power that leads to the establishment of institutions like the Digital Content Association of Japan (DCAJ), founded in 2001. Its aims are "to promote the production, distribution and use of high-quality digital content that will lead the computer networking of society. […] The objective of this promotion is to encourage the development of viable industries involved with digital content, raise levels of culture, realize a comfortable and affluent life for the Japanese people, and make an international contribution."[76] The MEXT White Papers as well as DCAJ stress the protection of digital contents as a top priority. In the Japan Times, journalist Alex Martin reports on the scenario and talks about the

[75] Ministry of Education, Culture, Sports, Science and Technology, ed., *White Paper on Science and Technology 2004 – Science and Technology and Society in the Future* (Tokyo 2005), online source: www.mext.go.jp/english/news/2005/04/05051301/part1/01-02.pdf. Kukhee Choo mentions the government's 'discovery' of the content industry in her paper given at the Conference on Japanese Popular Culture at the Institute of Comparative Culture, Sophia University, Tokyo on July 11, 2009. According to Choo, the term 'contentsu' is mentioned for the first time in government papers in 1994. With competitor South Korea installing their Digital Media Policy in 1999, MEXT in Japan follows along, mentioning the importance of manga and anime in its White Papers in 2000. Choo underlines the cultural promotional strategy at work here, with the government viewing the promotion of this sector as not only economically, but also as culturally fundamental.

[76] www.dcaj.org/outline/english/about.html.

link of the content industry with the term 'soft power', often referred to in this context. "[…T]o ride out tough times and to increase the content industry's international competitiveness, help from the government and cooperation among various players in the industry are needed", states Taizo Shinya of the Visual Industry Promotion Organization. The Ministry of Economy, Trade, and Industry is fostering the development of the field by spending huge amounts of money on entertainment content (1.87 billion yen in 2009). Yoshikazu Tarui, former lawmaker of the Democratic Party of Japan, puts it yet more clearly: "In reality, the competitiveness of a nation's entertainment industry and national power are often proportionate."[77]

The role of media art in this context is obvious. According to Masaki Fujihata, efforts to obtain funding for above-described projects at the borderline between engineering departments and artistic development are directly linked to the content sector and its recent boost.[78] Because of the government's focus on digital contents, it is en vogue to link the development of media art to commercializability in an alignment with governmental strategies – a field at first sight alien to an idealized Western concept of autonomous 'art'.

The establishment of the Japan Media Arts Festival is an examplary crystallization of this development. Already mentioned above, the festival was called into being by a MEXT decision in 1997 and is also financially supported wholly by a sub-institution of MEXT – the Agency for Cultural Affairs. A media art festival at first sight, it includes divisions like Manga, Animation, and Entertainment, alongside the Art Division. The specifically 'Japanese' set up of the festival, with the three contents-related sections dominating the organizational structure, gains relevance in light of its funding source and the promotion of the content industry. Operating Committee member Yasuki Hamano, professor at the Department of Human and Engineered Environmental Studies of the University of Tokyo, relates to this in his contribution to the 12th Japan Media Arts Festival's catalogue:

> There is a reason why we do not announce that this festival is an international exhibition even after opening the door to overseas countries. It is because it was one of our aims to convey a new perspective that proclaims a group of works to be 'media arts' from Japan,

[77] Cited in Alex Martin, "Looming Challenges. Japan urged to exploit its tech, pop culture", *Japan Times Online*, January 2, 2010, online source: search.japantimes.co.jp/print/nn20100106f1.html.

[78] Masaki Fujihata in an interview with the author, Geidai, Yokohama Bashamichi, Aug 7, 2009. Fujihata also mentions his own newly set up Graduate School of Film and New Media as part of Geidai within this context, which was promoted and set up "along with this wave" of government policies.

> even though other countries have not yet recognized such works as art. In order to be an international exhibition, we need to open the door not only to works but also to jury members. However, for the reason stated above, the Japan Media Arts Festival jury is still made up of Japanese specialists. But if there are foreign experts who agree with the purpose of the Japan Media Arts Festival, they will also be acceptable as juries.[79]

Hamano mentions a crucial point in his remark – the question of the (Western) concept of 'art' being tackled by the 'Japanese' media art discussed here.

A Media Art Festival with a Significant 'S'

Already the name of the festival conveys a significant aspect. We are not talking about 'media art', but 'media art*s*'. We are not dealing with international media art, but with specifically *Japanese* media arts. Commercialization, industrializability, Japaneseness in media art – the Japan Media Arts Festival is a model of how different concepts are intertwined in a field of arts, technological development, and cultural policies. In a country considering its content industry a sector of top priority, the coining of a term like Device Art is not surprising. "[…W]hile geekdom in Japan is a big business, it is even bigger globally, with scores of anime and gaming-related conventions".[80] Shaping her international image through terms like 'Cool Japan', Japanese pop culture has become recognized as a diplomatic tool.[81] It does not come as a surprise that "Japan Cool" is mentioned in the welcoming remark by Commissioner of the Agency for Cultural Affairs Shinji Kondo as an essential facet of the art show – the common denominator for the divisions art, games, animation and manga being their "mak[ing] use of digital technology".[82] In this denominator also lies the explanation as to why we are confronted with the plural s of 'art' in this context. Keiji Nagata, Chairman of the CG-Arts Society which organizes the festival, explains:

> 'Media GEIJUTSU' is not a translation of 'media art' which is used in Western societies, but has a meaning of the media arts including the field of entertainment represented by animation and manga. Ten years ago, some people disagreed to treat arts and entertainment equally. However, as the increasing number of entries from abroad shows,

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[79] CG-Arts Society ed., *12th Japan Media Arts Festival*, exh. brochure (Tokyo 2009), p. 5.

[80] Geoff Hiscock, "'Soft power' part of balancing act", *CNN.com*, Sept 21, 2006, online source: CNN.com, www.cnn.com/2006/WORLD/asiapcf/09/01/japan.softpower/index.html.

[81] Cf. Peng Er Lam, "Japan's Quest for 'Soft Power': Attraction and Limitation", *East Asia*, Vol. 24, No. 4, 2007, 349-363, p. 351. The term 'Cool Japan' has not been invented by a Japanese author, but by Douglas McGray in 2002, but it was immediately integrated into the "nation's mainstream discourse", ibid., p. 352.

[82] CG-Arts Society ed., *10th Japan Media Arts Festival*, exh. brochure (Tokyo 2007), p. 4.

> the number of artists who are favorable to the concept of the Japan Media Arts Festival where arts and entertainment coexist has increased on a world scale. […] Further, with the cooperation of the Ministry of Education, Culture, Sports, Science and Technology, the Japan Media Arts Festival has begun to have exhibitions and symposiums on the technological aspects of media arts, which gives the Festival the function of uniting art and technology.[83]

Subsuming the different genres electronic art (i. e. 'media art' in its 'Western' understanding), manga, animation, and entertainment (i. e. games and game consoles) under one overarching term 'Media Arts', the Festival has achieved its goal of promoting the various subdivisions in one coup, presenting media art as one part of a bigger unity, alongside the other sections.[84] "Uniting art and technology" is the common rhetorical clause that links the two fields in the medium of media art(s). Evidentially, all actors involved benefit widely from this set up – the artists and engineers presenting their art and research, of course the manga and animation artists, and the organizational structure in the background, fostering Japanese technological development and presumably enhancing Japan's 'soft power'.

As a means of 'cultural export', the Japan Media Arts Festival has also shown international presence with its exhibition *OTO – the Sound. Japan Media Arts Festival in Vienna 2009*. Showing mainly award-winning works dealing with music at MuseumsQuartier Wien in September 2009, the festival organizers have used the opportunity to claim international recognition for almost uniquely Japanese works in the four sections that constitute also the festival in Tokyo. Instruments by Maywa Denki were presented next to more conceptual artworks of the Art Division; *Tobae Akubidome* and *Kabu-Ongaku-Ryakushi*, two Edo- and Meiji-period picture prints were heading the catalogue section of the Manga Division;[85] animated movies were screened, as well as video games were shown. This exhibition of the Festival in Vienna was yet another one of its performances abroad – after Beijing in 2002, Shanghai in 2007, and Singapore in 2008, now in Europe. With its gaming section it was even partaking in the 2009 Ars Electronica festival, offering a whole tent of game consoles and video games not only for public display on the main square, but also for visitor use. Even though it could not be advertized officially due to Ars Electronica

[83] Ibid., p. 5.

[84] However, it was not until the year 2003 that the 'Entertainment Division' as such was added. Before that year, the art division was subdivided into two sections: Interactive and Non-interactive Art.

[85] *Japan Media Arts Festival in Vienna 2009*, exh. cat., MuseumsQuartier Wien (Vienna 2009), p. 44-45.

reglementation, the game section was completely allocated and financed by game manufacturer Nintendo. *Japan Game*, as the 'exhibition' in Linz was called, was neatly integrated into the general Ars Electronica discourse. Again, the catalogue text points to the link between art and technology, the open concept of 'art' applied here, and the integrative function of the 'media arts'. "If one of the roles of media art in our age with the evolutional technology is to have a connection between technology, society and art, can it be said that computer games have the same role as media art?"[86] Neither this rhetorical question, nor the whole text address in any way the commercial component underlying the issue. Striking is also the mentioning of the very 'Japanese' in the media arts, the seemingly specific Japaneseness of works in this field.[87] "We hope the audience to enjoy [sic] and focus on the similarity between the artistic expression and media art of the games."[88] This wish sounds reminiscent of what Kusahara expresses when she mentions the Japanese tradition of 'mitate' in the context of Device Art. We are not dealing with an obvious commercial pursuit, but with a cultural one in national coloring.

The ultimate reason for why rhetorics of national characteristics have entered the discourse around media art in Japan can be found in the scenario described above: the media art(s) are closely linked to an important Japanese industrial branch – to the industry of digital contents. As such, they are partly instrumentalized in funding agencies' policies, ultimately in governmental strategies to support the sector of 'Cool Japan', of soft power, in order to become a 'cultural export'. This explains the national phrasing around a lot of the artworks this chapter has highlighted.

However, it is worthwhile to take a deeper look into the rhetorical lining of this 'Japaneseness'. Examples of a proclaimed Japanese character are multiple in a field usually designated as international. In the case of manga and anime, this is not as striking as in the field of (media) art, with several authors pointing out the nationally unique notion of 'art' in focus here. If foreigners have so far not been accepted as jurors to the Japan Media Arts Festival because they are said to have a different

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[86] *Japan Media Arts Festival in Vienna 2009*, exh. cat., MuseumsQuartier Wien (Vienna 2009), p. 82.

[87] "There are vast fields on the boundary between art and society, and these fields have been created mainly by those persons who have not been defined as artists according to conventional ideas. […] In Japan, the boom of [… video games] has influenced heavily on the society. This influence can also be seen in the Japanese media art works.", ibid.

[88] Ibid.

understanding of the concept of art, if 'mitate' is conceptually and seemingly generically linked to electronic art in 2009, if European art institutions present Japanese video games, one must wonder whether there is a deeper reason for this insistence on national traits.

The question is whether 'Japaneseness' merely functions as a label, whether 'Japanese media art' is just selling well or estimated to do so, or if the recurring trope of Japaneseness does not also transmit a notion of something peculiar to Japan in general. There is evidence to assume that it is not only export policies and strategic funding that cause rhetorics of national characteristics to come up frequently, but that inversely those policies and ideas are built upon pre-existing phenomena and rhetorical forms. For this purpose, I deem it worthwhile to cite longer passages from interviews conducted with members of the media art scene in Tokyo:

> "Maybe we are different from Western people. That's why we have an attitude of familiarity to science or technology. And we have kind of a playful mind, we can play [with everything], or entertain with toys… I don't know if Western people think familiar [concerning] science or technology. I think they are struggling with science and technology, I'm not sure. But we can adapt all the elements from everywhere and we can play or we can enjoy or we can entertain with them. That's the big difference, I think. […] I think also European people and Japanese people have a familiarity with nature. They love the mountain, or lakes, or forest, or rain, or snow. But especially the Japanese people can sympathize with them, with our mind. Just like 'rain is falling but someone is crying', you know… […] I can only say it poetically, but in Japan, the important element is the humidity. It is not so dry, but not so wet, it's a comfortable climate. That's a typically Japanese characteristic. […] We are familiar with nature and all the phenomena outside. That's a very big difference."[89]

> "In Japan, we live on an island, we never had a border around. We are apparently not so much separate like Europe. You always had to defend yourselves against the enemy and the borders always changed. Japan is very much isolated culturally and also of course geographically, and we didn't have to spend so much stress on fighting the enemy. This is one thing, I think. Also, communication is part of Japanese-based culture, we always could speak in Japanese, so we didn't have so much conflict, but it means that we have so much a monolithic culture. We did not have so many encounters with the other, or different cultures or ideas or concepts. This is maybe one thing. People could play with not so much language-based communication, they communicate by behavior or by things. Also, the weather was always changing […]. We always had the idea that everything is

[89] Atsushi Wakimoto of CG-Arts Society in an interview with the author, Tokyo, July 13, 2009.

> flowing and changing, because we have a typhoon coming. Also, we have a very sensitive change of the weather and also the seasons. […]
>
> I think, many explanations can be found in nature in Japan. Also, if you see the Japanese house, the outside and the inside is in a way so much ambiguous. We can change the screen or the doors depending on the season. So at that time, the inside and the outside have some kind of integration into each other. In Europe, you had a more stone-based structure and also you divided between outside and inside. So most of the thinking developed in modern Europe set up your consciousness or identity. You want to see the world, you want to observe the world, you want to analyze, you want to gain the world by observing."[90]

It is interesting to hear media art scholars bring up a 'Japanese' love of nature, Japanese traditional architecture, or Japanese geographical circumstances when talking about and explaining an alleged distinctness of media art in Japan. In reflecting on particularities of technology and its implementation in the East Asian country, the link to 'Japaneseness' is a common scheme to follow.

Renowned anthropologist Harumi Befu has analyzed this kind of commonplace argumentation in his book on 'nihonjinron'. Examining the discursive shaping of a national essentialism, he sees "the heat [in the debate of misunderstandings between 'the West' and Japan] to be on the Japanese side, having to excuse itself and explain itself. In this effort, Japan has often resorted to 'cultural exceptionalism' as a defensive explanation." [91] Nihonjinron, translating into 'theories about the Japanese' or 'discourse on the Japanese', is a theoretical term describing a genre of texts presenting Japan and the Japanese people as unique and differing from the other nations in their national traits. Authors of such texts have mostly come from Japan, but there have also been foreign scholars joining in or even forging the phenomenon. An early example of such a text is Ruth Benedict's study *The Chrysanthemum and the Sword. Patterns of*

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[90] "But in Japan, we don't have any kind of geographical map. You have a more logical own matrix. To perceive and to observe what is happening, then you think you understand the world. But the Japanese people, we try to understand more ambiguously, so we don't make a clear map, or we don't make a clear structure, or matrix. We try to feel something, by interrelating, without words. You have more structure, mathematics, also measuring and more language-based understanding of the world, separating between you and the world. In Japan, we don't do that. Of course, in Europe there are some philosophers, phenomenologists, perceiving this kind of world. But mostly, European knowledge has developed into this kind of direction, this kind of relation between the human being and the world. And it works so well. Then you produced many interesting or useful technologies that we also use a lot here in Japan." Yukiko Shikata, senior curator at NTT ICC and formerly at Canon ARTLAB, in an interview with the author, NTT ICC, July 22, 2009.

[91] Harumi Befu, *Hegemony of Homogeneity. An Anthropological Analysis of Nihonjinron* (Melbourne 2001), p. 1.

Japanese Culture,[92] published in 1946 – a highly influential text on a putatively distinct 'Japanese' character and culture. The boomphase of nihonjinron literature – encompassing foremost texts for a broader audience reaching best-seller status, but also academic publications – spanned from the 1960s to the 1980s. Linked to Japan's stunning economic success at that time, the theories tried to explain it as a result of characteristically national factors, like the famous 'Japanese groupism' as opposed to 'Western individualism', and a Japanese corporate spirit which was said to have developed out of the rice farming tradition in the country.[93] Befu mentions the common parallelization of distinct cultural aspects with the ecological givens (like monsoon, typhoons, earthquakes, and humidity) and the architectural forms deviating from them (i. e. open houses as relating to a lack of privacy, causing a certain collective orientation), as well as a "linguistic determinism", explaining contemporary phenomena with statements on Japanese verbal and nonverbal communication.[94] Putting nihonjinron into a historical perspective, Befu comes to the conclusion that it is the exceptional confrontation with 'the other' which caused the discourse on national uniqueness to gain such a widespread significance in Japan and rendered it perceivable until today. He discerns a certain kind of proto-nihonjinron during Tokugawa period (1603-1868) and an early counterpart during Meiji restoration (until 1912), but locates its heyday with the dissemination of mass media after World War II.[95] Marveling at their own economic achievements in the 1960s, a new kind of self-confidence spread among the Japanese, "now finally able to take the cultural relativist position, rather than accepting uncritically and in toto the victor's value judgments" after a period of American occupation.[96]

Statements and explanations like the ones by Wakimoto and Shikata considerably evoke tropes of nihonjinron. Linking a Japanese culture of cell phones and video games to an inert playfulness which in turn relates to linguistic characteristics, parallelizing a love of nature with a wide-spread and less critical acceptance of technology, and seeing Japanese architectural traditions in line with a Japanese way of relating to nature *and* technological objects – all these ideas come as a surprise at first

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[92] Ruth Benedict, *Chrysanthemum and the Sword. Patterns of Japanese Culture* (Boston 1946).

[93] Befu 2001, p. 14; pp. 21; 139.

[94] Ibid., p. 17; pp. 35.

[95] Ibid., pp. 126.

[96] Ibid., p. 139.

encounter, yet seem plausibly integratable into the general discourse of 'Japaneseness'. Also the White Papers issued by the Ministry of Education in 2005 underline the "different cultural background than [sic] the nations of the West", pointing to a rising interest in Japanese science and technology by Asian countries, "with their similarity to Japan in being culturally distinct from the nations of the West".[97] The reference to being different and the importance of a comparison with 'the West' encompasses many a textual source also in the sector of education and technological development. Even in a field as 'culturally neutral' as technological development at first sight, the 'cultural difference' of Japan becomes an important factor for its advocates.

Device Art or the 'media arts' promoted by people around the Japan Media Arts Festival are said to reveal something particularly Japanese. This is expressed by the ready integration of playfulness, entertainment, and gadgetry into the art discourse, as show Wakimoto's remarks. Shikata, formerly senior curator at NTT ICC and curator at Canon's ARTLAB, mentions similar themes, albeit with a different focus. In her opinion, a Japanese distinctness does not only have positive aspects to it which manifest themselves in a certain way of communicating without words, in a greater openness toward technology, or in the frequent topos of the lack of a border between inside and outside. A positive aspect Shikata perceives for the 'Western' side is the development of mathematics and technology, adapted and subsequently further developed by the Japanese.

> Of course, technology is much easier to get in Japan, in daily life. There are many technological gadgets and you can play easily. And people also like the robots, in the figure of the human being. They really love that. For European people this is something very different. For European people, technology and nature, or nature and people, or technology and people and environment is something totally different. So they feel scared when they see human figure robots, for example, or technology under the cover of a human being. It is a very scary point in your concept, I think. We have a different kind of sympathy to technology in relation to the human being. Because we see technology as an extension of our body, it's much more intimate. We can enjoy and we can also extend our feeling and also physical body with technology. This is the concept. We can enjoy high technology or low technology or even smaller gadgets. It is more of a friend, not so much an object or enemy.[98]

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[97] Ministry of Education, Culture, Sports, Science and Technology 2005, no pag.

[98] Yukiko Shikata, senior curator at NTT ICC and formerly at Canon ARTLAB, in an interview with the author, NTT ICC, July 22, 2009.

A crucial aspect for all scholars seems to be the relation between the human being and the object in Japanese and in Western culture. The common belief is that the Japanese have a rather different attitude toward anthropomorphic robots than Europeans or Americans. This is either explained by Shintoism, the Japanese indigenous religion, with its animist tradition of ascribing some kind of 'spirit' not only to humans, but also to animals, plants, and stones. Another explanation is often given by what Shikata mentions, reasoning for a substantial Japanese ability of accepting nature as part of the own body. This is then justified with a reference to traditional Japanese architecture without a fixed inside and outside, with a less rigid mindset as to de*fin*ing the 'I' and the 'other'.[99] Encountering technology and specifically robots with much less skepticism is an important facet oftentimes mentioned in this context in Japan. Although Shikata does not want to make a point of this Japanese attitude toward the anthropomorphic machine or of the subject-object relation in general, she brings it up in a discussion about the implementation of technology in the Japanese society. Shikata is neither a promoter of Device Art, nor in the inner circle of the Japan Media Arts committee. Due to her institutional background she is rather oriented toward a more 'international' media art, as have shown her projects at Canon's ARTLAB in the 1990s as well as her curatorial commitment at NTT ICC.[100] It can hardly be an interest to foster a 'Japanese' kind of media art which leads Shikata to her remarks on the alleged differences between Japan and the West.

Historian of science Kenji Ito's reflections on the public perception of technology depict the situation in the Asian country as a specific one, but his approach "aims to de-essentialize cultural meanings of science and technology in Japan". His text discusses the historic change in public attitudes toward technology before and after the second World War and argues for a more differentiated evaluation of the Japanese acceptance of technological matters. Ito observes a change in the public opinion due to World War II, with technology perceived as something rather threatful and belonging to 'the enemy' *before* the war, changing to something powerful and positive, to be possessed and further developed *after* the war, that is after the drop of the atomic

[99] Cf. Shikata in interview; see above.

[100] "ICC is maybe more understandable for general art history or artistic situation. Because they are trying to do a good work and connect art and science and new technology. Manga and animation is still a little bit difficult, so sometimes it is difficult to explain [to an international audience]. Also we now struggle to find a good definition because it is difficult to explain about why we have come about to include *every*thing…", Asami Hosokawa of CG-Arts Society, comparing NTT ICC with the Japan Media Arts Festival, in an interview with the author, Tokyo, July 13, 2009.

bomb. “Science and technology, as symbolized by Astroboy, became a friend of the Japanese, rather than the enemy’s tool.”[101] In his analysis of the famous Japanese comic strip *Astroboy*, Ito views the robot’s depiction as “a crystallization of the future Japan’s (advanced) science and technology and a ‘child of science’”.[102] “The message is clear: the robot (i.e., technology) is inherently good.”[103] He sees the values and norms trans-ported by the comic as representative of those in postwar Japan.

Also Cosima Wagner calls for a “differentiated view of the ‘classical’ arguments for the popularity of robots”.[104] She retraces classical lines of argumentation on the presumably widespread Japanese acceptance of robots and concludes that this stereotype does not always withstand a more detailed scrutiny. Wagner does not completely rule out cultural factors in the Japanese fascination with (humanoid) machines, but stresses the fact that “the Japanese government has become a major driving force for the current promotion of next generation robot technology.”[105] Her emphasis on governmental economic strategies behind the historical and contemporary appreciation of this technological niche is undermined by reports of the Ministry of Economy, Trade and Industry (METI), which stress ‘robots’ as well as ‘content’ as two of the ‘Seven Promising Industry Areas’.[106]

With Ito and Wagner, I want to set media artistic development in Japan into a broader perspective and take a look at its dependence on the public perception of technology. It seems justifiable to speak of a certain Japanese view on technology without essentializing unduly. The matter is thus revolving around the question whether media art in Japan and its promotion can be regarded as differing from the one in Western countries due to a substantially dissimilar role of technological development in her society. The hypothesis put forth then is that media art, and especially recent phenomena like Device Art and the art(s) promoted by the Japan Media Arts Festival, are only understandable after an analysis of technology’s social

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[101] Kenji Ito, “Robots, A-Bombs, and War. Cultural Meanings of Science and Technology in Japan around World War II”, in: Robert Jacobs ed., *Filling the Hole in the Nuclear Future. Art and Popular Culture Respond to the Bomb* (Lanham et al.: Rowman & Littlefield 2010), 63-97, p. 87.

[102] Ibid., p. 84.

[103] Ibid., p. 85.

[104] Cosima Wagner, “’The Japanese Way of Robotics’: interacting ‘naturally’ with robots as a national character?”, in: *Proceedings of the 18th IEEE International Symposium on Robots and Human Interactive Communications*, 27.9.-2.10.2009, Toyama / Japan, 169-174, p. 169.

[105] Ibid., p. 173.

[106] Ministry of Economy, Trade and Industry, *Nakagawa Report. Toward a Sustainable and Competitive Industrial Structure (Summary)*, [Tokyo] May 2004, p. 6.

role in Japan. Part of the specific status of technology in Japan is – as has been mentioned – the unique popularity of robots, or humanoid machines. Reflecting on the historical meaning of robots from the Expo 1970 in Osaka until nowadays, Cosima Wagner has convincingly described how robots like Honda's ASIMO have to be regarded as "cultural products and stagings".[107] Hironori Matsuzaki follows this line of thought in his statement that an ethical potential for conflict due to the essential difference between man and machine is much less pronounced in Japan, since an unproblematic coexistence of the two is accepted here more easily.[108] It is the comfort in integrating technological matters into every-day life which ICC-curator Shikata points to when she speaks of the fact that "technology is much easier to get in Japan, in daily life". It is this relation between subject and technological object which is constitutive of what is quintessential for this case study: the 'gadget' in art and the implications following.

In her article on media art in Japan, Machiko Kusahara reflects on the concept of art. Already the title of her article, "Considering Media Arts through 18th Century Japanese Culture", suggests two things: first, its publication in an exhibition catalogue issued by the Japan Media Arts Festival, understanding media art in its *plural* meaning and second, setting up a genealogy of contemporary media art as being intrinsically linked to Japanese traditions like bonsai, kabuki, and mitate. Kusahara alludes to a certain "culture of play" in Japan and the relation between subject and object when she describes mitate as "an act of appropriating things originally used for a totally different reason as tea utensils".[109] By this 'act of appropriation' she delineates a tradition of enjoying beautiful objects, be they 'works of art' in the Western sense like paintings on scrolls, be they tea utensils or elements in a garden.

> Many Japanese media art works share entertaining and playful elements similar to those observed with Maywa Denki's […] works. In an international context these elements often lead to a misunderstanding as lack of seriousness. However, having a playful surface and having a serious concept do not contradict. Discovering and reading multiple

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[107] Cosima Wagner, "Von Astro Boy zu ASIMO? Einblicke in die japanische Robotik", paper given at Jahrestagung der Gesellschaft für Technikgeschichte (GTG) "Geschichte(n) der Robotik", Hochschule für Gestaltung, Offenbach / Germany, May 23, 2009.

[108] Hironori Matsuzaki, "Die Entwicklung von humanoiden Robotern im Kulturvergleich – Europa und Japan. Eine wissenssoziologische Analyse der Grenzfragen der Mensch-Maschine-Beziehungen", paper given at Jahrestagung der Gesellschaft für Technikgeschichte (GTG) "Geschichte(n) der Robotik", Hochschule für Gestaltung, Offenbach / Germany, May 23, 2009.

[109] Machiko Kusahara, "Considering Media Arts through 18th Century Japanese Culture", in: *Japan Media Arts Festival in Vienna 2009*, exh. cat., MuseumsQuartier Wien (Vienna 2009), p. 8.

> layers in an art work is a part of the cultural tradition including aforementioned *mitate*, and is often seen in the genres of manga, animation, and games. […] The borders between art, design, architecture, and fashion are disappearing internationally and Japanese media arts have an important role to play in this process.
>
> Japanese media arts contain a mixture of Japanese and international elements. In the present age […], knowing the cultural history and the present state of Japanese 'art' might bring a useful idea in foreseeing the future of media arts.[110]

In a few sentences, Kusahara outlines a Western critique of Japanese media art and the putative disappearance of boundaries between art, design, and architecture, while she connects both aspects to a notion of 'Japaneseness', emanating from Japanese cultural traditions. A Western critique of 'Japanese' media art is a topic coming up often in this context. In an interview with journalist and publisher Tetsuya Ozaki, media artist Ryota Kuwakubo takes a stand vis-à-vis Ozaki's reference to this critique by advocating user-friendliness in his artworks.[111] Hiroo Iwata replies to Hiroshi Harashima's remarks at a symposium on 'Japanese Media Arts Supported by Technology' in February 2009: "Device art is industrial art. Westerners will find this quite shocking. Basically, a device can't become art. The history of western arts started with painting and sculpture whereas in Japan, it started with jars or tea ceremony bowls. This kind of thing is the critical difference, in my opinion."[112] Kusahara, Ozaki, and Iwata convey a notable awareness of 'Western' voices on depth or superficiality in certain Japanese media artworks. The reaction is always a similar one – artworks are explained, even defended by an acknowledgment of the Japanese tradition. This is evocative of Befu's remarks on "'cultural exceptionalism' as a defensive explanation". At least partially, the invocation of Japanese values in artworks seems to be a response to a 'Western gaze', a Western judgment – or is, as explains Kusahara, caused by a confrontation with the Western art concept, differing from the one indigenous to Japan.

Claiming an alleged disappearance of the delimitations between art, architecture, and design (– or at least hoping for this to happen) is not an uncommon theme in the international media art discourse.[113] A socially disconnected thinking in art, the lack of

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[110] Ibid., p. 9.

[111] Ozaki 2005, p. 67.

[112] Symposium report, 12th Japan Media Arts Festival, online source: plaza.bunka.go.jp/english/festival/2008/report/symposium/theme03/.

[113] This idea lies also at the inception of the MIT Media Lab or Ars Electronica's Futurelab. Further e.g. Roger Malina, "Welcoming Uncertainty: The Strong Case for Coupling the Contemporary Arts to

integrating new technologies, and barriers between disciplines thus hinder a highly needed innovative and interdisciplinary thinking.[114] Kusahara's article is representative of a rhetorical pattern which evokes the Japanese tradition in this context. In this conception, the specificity of Japanese media art(s) derives directly from a traditional way of appreciating craft *and* art, or maybe craft *as* art. It is not only Kusahara who sets up this kind of genealogy. Under the headline 'The relationship between the characteristically Japanese cultural artefacts of *kogei* (industrial crafts), and media arts' at the symposium in February 2009, curator Tomoe Moriyama states: "Japan, where technology and art have long been fused, may be the ideal environment to produce media arts."[115] An enhanced consciousness of Japanese cultural customs joining art and functionality serves as a foundation for such a viewpoint. Symposium speakers Harashima, Moriyama, and Iwata all agree on the fact that a "digital industrial art movement" in Japan stems from a traditional fusion of arts and crafts.[116]

Kusahara accordingly reflects on the meaning of 'art' as a fixed concept and on the notion of 'high' and 'low' in art. She points out that the word 'art' or 'fine art' as being linked to a certain (Western) conception was introduced into the Japanese language only in the late 1800s, that is during the Meiji Restauration after Japan opened up its borders. *Bijutsu*, the translation of 'fine art', was thus a term imported into Japanese thought without preexisting notions of a Western definition of 'art'.[117]

There have been noteworthy contributions to the debate on this linguistic and ideological import into the Asian country. The general consensus is that the Japanese term for 'art' itself was coined during the early Meiji period.[118] Along with the concept of 'art' came the necessity of a 'history of art' – a 'Japanese art history' had to be set up following the import of the Western art concept. All this happened in a period of intense debate around the nation state Japan, in a phase of negotiating Japanese

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Science and Technology.", in: Jill Scott ed., *artists-in-labs. Processes of Inquiry* (Vienna et al. 2006), 15-23.

[114] Christa Sommerer and Laurent Mignonneau, "Introduction: Art and Science - a Model of a New Dynamic Interrelation.", in: Christa Sommerer, Laurent Mignonneau, eds., *Art@Science* (Vienna 1998), 7-23, p. 8.

[115] Symposium report, 12th Japan Media Arts Festival, online source: plaza.bunka.go.jp/english/festival/2008/report/symposium/theme03/.

[116] Ibid.

[117] Kusahara 2009, p. 8.

[118] J. Thomas Rimer, "Hegel in Tokyo. Ernest Fenollosa and His 1882 Lecture on the Truth of Art.", in: Michael F. Marra ed., *Japanese Hermeneutics. Current Debates on Aesthetics and Interpretation* (Honolulu 2002), 97-108, p. 104.

identity in almost violent cultural confrontation with 'the West'.[119] Art treatises were written, debates on the 'right way' to paint were nurtured by a controversy of traditionalism versus Western realism, academies according to the occidental model were founded. All sides desperately tried to get the upper hand in a struggle of modernization, Westernization, and the defense of traditional values.[120] This struggle, raging throughout all fields of Meiji society – in economics, politics, education – clearly left its marks also in the cultural sphere and in the art world. The import of a whole new concept related to the enjoyment of beauty and the unseen set of value judgments coming along with it created a remarkable shift in the perception of objects as disparate as pottery, painted sliding doors, or woodblock prints on paper. "It was during this time of drastic nationalism that artists began to 'Japanize' Western-style painting"[121] – it was from now on that 'Japanese' artworks were set into relation to their 'Western' counterparts.

After more than one hundred years passed, one can still grasp what might lie at the core of a Japanese identification process or self-definition in art. When in 2009 Kusahara's article on media art deals with the historical evolution of the concept of 'art' in Japan, this is significant with respect to the construction of genealogies in art historical writing on the one hand, and to the problem of essentialism on the other. The crucial point is the discussion of something 'Japanese' in media art nowadays which may stem from a discrepancy between a 'Western' conception of art and whatever culture of enjoying 'the aesthetic' there might have been before, a culturally distinctive mode of relating to objects and – also – technology. As has been highlighted above, nihonjinron, that is certain tropes of 'Japaneseness' play a notable role in this debate, as does the problem of unduly essentializing 'the Japanese' and 'the other', i. e. 'the West'.

A digression on the historical foundation of the term 'art' is worthy of recognition for a better understanding of the discussion of media art and its role in Japan. Kusahara is not the only one referring to this aspect so significant for the Japanese art world – various actors in the media art scene bring it up and use it to explicate characteristics

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[119] Inaga Shigemi, "Cognitive Gaps in the Recognition of Masters and Masterpieces in the Formative Years of Japanese Art History, 1880 - 1900. Historiography in Conflict.", in: Marra 2002, 115-126, p. 115.

[120] Rimer 2002; Shigemi 2002; Kambayashi Tsunemichi, "Ogai, Schelling, and Aesthetics", in: Marra 2002, 109-114.

[121] Tsunemichi 2002, p. 110.

of certain artworks; *and* their reception in Japan.[122] In order to contextualize Device Art, the Japan Media Arts Festival, and other such contemporary phenomena of Japanese media art, it is valuable to take into account not only the current perspective on technology's implementation, but also the very status of art in the Japanese society. It is between these two poles that Device Art and the Japan Media Arts Festival with its art and entertainment divisions can be localized.

Chairman Keiji Nagata of CG-Arts Society, the organizational backbone of the Japan Media Arts Festival, unveils the composite 'media geijutsu' ('media arts') not as a translation of the Western term 'media art' with its fixed connotations, but as having "a meaning of the media arts including the field of entertainment represented by animation and manga".[123] In doing so, he tries to rule out other, Western conventional understandings of the festival's title, or more specifically, of its English translation of '文化庁メディア芸術祭'.[124] This connotative discrepancy between 'media geijutsu' and 'media art', whether innate or constructed, reveals an enhanced Japanese confidence to contribute to an artistic current while integrating proper cultural values. Furthermore, as explains Hosokawa, not only do the two terms connote different conceptions of media art, but also does 'media' (メディア) in Japan "stand for new technology, or just for 'new', sometimes 'mass media'".[125] What is underlined then is the notion of the new: art in Japan's techno-society. Wakimoto adds that the meaning of 'geijutsu' is more technical than its contemporary counterpart 'art', that it tilts toward 'skill' and 'technique'.[126]

The Japan Media Arts Festival presents itself as a Japanese electronic media and animation festival. Listening to various actors of the festival and their views about art and media art(s) leads back to its inception by the Agency for Cultural Affairs. The dominating conception of 'media art' here is utterly different from the international understanding of the English term. Media geijutsu in this context is declaredly

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[122] Also Shikata, Wakimoto, and Hosokawa mention it in interview with the author.

[123] CG-Arts Society ed., *10th Japan Media Arts Festival*, exh. brochure (Tokyo 2007), p. 4.

[124] 文化庁メディア芸術祭 literally translates into 'Agency for Cultural Affairs Media Arts Festival', carrying the funding institution's name in its Japanese original.

[125] Asami Hosokawa of CG-Arts Society in an interview with the author, Tokyo, July 13, 2009.

[126] "Of course, we translate 'geijutsu' into the word 'art' in English, but they are very different. Of course, 'geijutsu' and 'art' have the same meaning of 'téchne' or 'ars' as in the Greek or the Latin word, but 'geijutsu' means something more technical. Like 'making something', like 'skill', 'technique'." Wakimoto of CG-Arts Society in an interview with the author, Tokyo, July 13, 2009.

Japanese.[127] Accordingly, the "Basic Law for the Promotion of Culture and Arts" (initiated by the Agency for Cultural Affairs in December 2001) explicitly calls for a promotion of the 'media arts' (メディア芸術 – media geijutsu), that is of "movies, cartoons, art etc. using electronic devices and computer animation".[128] As has been elaborated above, this way of conceiving the media arts is largely influenced by the government's promotion of it. Also here, media art comes along in the guise of something immanently Japanese as a facet of the broader spectrum of anything involving moving pictures and technology and as relating to an engineered society in general.

There are other voices in the field. The Japanese name for the Department of Film and New Media at Tokyo's University of the Arts – Geidai – translates into 'Visual Media Studies'[129], hence does not make use of the term 'media geijutsu'. In general, Masaki Fujihata, director of this new graduate school, is skeptical about the current use of the term 'media art' in Japan. He perceives 'media art' as a standing term internationally and claims to have protested against the name of the Japan Media Arts Festival before its establishment. He clearly sees a strategic promotion of the entertainment and game sector at the root of its inception by the Agency for Cultural Affairs.[130] He considers technology as something universal, not bound nationally, thus understands media art as independent of national values. Yukiko Shikata of NTT InterCommunicationCenter is much less outspoken in this respect, but also she stands for a branch of media art oriented toward the international model. Having been deeply involved in the media art scene already in the late 1980s, Shikata has always promoted international exchange in her curatorial approach of media art. Yet speaking of the conception of 'art' in Japanese thought, she concludes that there are still certain

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[127] Cf. Yasuki Hamano's statement, footnote 79.

[128] www.bunka.go.jp/bunka_gyousei/kihonhou/kihonhou.html.

[129] Orig. 映像メディア学.

[130] "You know, the Ministry of Education and Culture [MEXT] is the main ministry, and the Agency for Cultural Promotion [Agency for Cultural Affairs] is *under* this ministry, so they have a very small budget. Their main concern is about *conserving* the [traditional] art object all over our country. […] But they didn't focus on manga and animation and other things. That's why they started a festival. It's really strange, they pushed *every*thing that was not managed before – manga, anime, digital art, and game. I was one of the members on the committee, and we protested a lot about the use of 'media art' for this festival. Because, 'media art' is already a *known* term in Europe, media art is focussed on video art and new media art! So normally, one wouldn't understand it. One wouldn't understand manga and anime as new media! So we protested and tried to protect it, but they didn't hear anything of our talking and they started the Media Arts Festival." Masaki Fujihata in an interview with the author, Geidai, Yokohama Bashamichi, Aug 7, 2009.

divergences between the Western and the Japanese notion of the term. However, "now, we have many art museums, so the definition of art from Europe is getting very popular now. Of course, there are certain differences, also the tradition of art in society is totally different. But maybe the definition of art is getting much more similar than at the time it was imported in Meiji era."[131] Shikata stresses the culturally rooted perception of aesthetic objects rather than a difference of a 'Western' and a 'Japanese' media art.

The perception of objects, that is their handling, their integration into daily life, the appreciation of the beautiful – all this relates to technology's implementation in society. Observers do not get tired of mentioning how omnipresent technological items are in every-day life in Japan. The myth goes that Japanese cell phones are by far more advanced than their European or US-American counter pieces. Tokyo's quarter Akihabara has reached cult status due to its shops selling any electronic item one can dream of. Data show that Japanese companies still hold the world's largest share in the production of electronics and IT.[132] Such a place value of technology significantly coins a society and its attitudes toward it. Masaki Fujihata therefore sees one historical reason for the popularity of technological gadgets and for particularities like Device Art or the Japan Media Arts Festival in Japan's economic development after World War II. Reflecting on possible reasons for the eminent involvement of engineers in the promotion of media art, Fujihata relates the current situation to the boom production of consumer products after the war. "You have to focus on the evolution of consumer products in Japan, as you know Sony, Panasonic – so many consumer product [companies]. It is the main industry for electronics in the Japanese country, for our country, because we didn't have funding for the weapon industry. I think this is quite a big thing. The Americans' computer industry was funded a lot [by] the army."[133] With the funding situation in Japan differing from the one in the West, the technologies on which engineers focused also differed from its Western correspondents, putting emphasis on user-friendliness, every-day usage, and practical qualities.

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[131] Shikata in interview with the author, NTT ICC, July 22, 2009.

[132] Thus accounting "for 20% of the global total in 2009, the majority share by country", Japan Electronics And Information Technology Industries Association (JEITA), online source: www.jeita.or.jp/english/press/2009/1214/english.pdf.

[133] Fujihata in an interview with the author, Geidai, Yokohama Bashamichi, Aug 7, 2009. On the importance of military support for the development of technological tools used by art see also Christiane Paul, *Digital Art* (London 2003), p. 8-10, 21.

> Then most of the engineers' focus [was] about getting better products, easier to use for the normal people, cheaper, faster, you know, that's the purpose of the development. […W]hen Sony started to sell the Walkman – you know, the Walkman is a symbolic object, but Panasonic and Aiwa, Olympus, *every* other consumer product company started to sell a totally similar product. Unbelievable. This is the situation. They've been chasing each other. 'Our product is cheaper' or 'easier to use' […] Just after World War II, we were so depressed because we had lost. And then we faced the modern culture and technology from America. I think this was kind of a shock and obsession for our daily life and we thought that we have to modernize. And 'modernize' equaled that we had to get consumer products – refrigerator, washing machine, television… That is my understanding. In the 60s, every family had to have television; in the 70s, every family had to change this television to color… A lot of competition…![134]

The development of technological gadgets as an essential part of Japanese consumer culture influenced the societal status of electronic material. The media art scene – its current situation, its funding sources, its historical emergence – is in more than one way directly entangled with technological development and its promotion.

Finally, international appearances at art festivals of engineers like Junji Watanabe or Hiroshi Ishiguro round off the picture of this art-technology relationship in Japan. Neither producing Device Art, nor 'art' in any stricter sense, Watanabe and Ishiguro represent a whole group of engineers that exhibit their scientific research at international art conventions.

Watanabe's interface works *Touch the Invisibles*, *Saccade-based Display*, and *Save YourSelf!!!*, always co-productions with colleagues, have been shown at Ars Electronica festival, Japan Media Arts Festival, or the International MedTech Art Show at the National Taiwan Museum of Fine Arts among others. *Touch the Invisibles*, for example, is a fingernail-mounted tactile interface with which the user can 'touch' virtual "lilliputians" on a screen.[135] In spite of several prices won at art shows, Watanabe does not understand himself as an artist, nor does he claim his works to be art. He soberly labels them 'research in progress' and pursues his career in interface research at NTT Communication Science Laboratories. Open to presenting his work at art venues, he benefits from wider publicity.

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[134] Ibid.

[135] Cf. the corresponding research paper: Hideyuki Ando, Junji Watanabe et al., "A Fingelnail-Mounted Tactile Display for Augmented Reality Systems", *Electronics and Communications in Japan*, Part 2, Vol. 90, No. 4, 2007, 56-65.

"Human Nature", the Ars Electronica festival of 2009, featured Hiroshi Ishiguro and his *Geminoid HI1*. *Geminoid H*[iroshi]*I*[shiguro]*1* is a remote-controlled robot strikingly resembling its creator's complexions. The seated humanoid can move its head and upper body as well as its lips when speaking and can be controlled by an operator wearing a headset with integrated motion capture system. On a panel with media historian Friedrich Kittler in one of the festival's conferences, Ishiguro explained his vision of future robotic engineering and was given the opportunity to promote his Geminoid project. Internationally, Ishiguro is well known for his research in 'intelligent robotics' with a focus on humanoid machines and communicational research.[136] The art festival's focus and the newly opened Ars Electronica Center presenting various 'labs' on its main floor, "attest[ing] to the affinity between art and science, and to our timeless fascination with our own kind",[137] was the ideal platform to integrate Ishiguro's RoboLab and his robot which attracted high media attention. Ishiguro's interdisciplinary engineering and technology discourse overlaps with crucial questions of what might be called 'techno-society'. His work touches upon the perception of humanoid robots in Japan and the West in investigating people's reactions to very humanlike machines.[138] In his contribution to a symposium organized by artist Fujihata within his CREST-funded project, Ishiguro talks about his understanding of robots for nowadays' society and for a possible future. Artists and engineers here meet in a discursive framework engaging in tropes of common art-science rhetorics, evoking Da Vinci as the omnipresent model of early art and technology interaction, and refer to various similarities of the two divergent fields.[139] It is this discourse that envelops the whole field of science and technology at the intersection with the arts. When Ishiguro talks about his robotic research and his quest for what it means to be human (i. e. how to imitate humanness as accurately as possible with machines like the Geminoid), he digs deep into the field of human-

[136] This is reflected in the election of Ishiguro as one of the "100 Japanese respected by the world" in July 2009, a list published annually by Newsweek Japan: newsweekjapan.jp/magazine/5745.php.

[137] *Human Nature. Ars Electronica 2009*, exh. brochure (Linz 2009), p. 36.

[138] Christian Becker-Asano, cooperate researcher in Ishiguro's lab, is analyzing differences in the perception of humanoid robots' laughter with respect to the participant's cultural background. Cf. on laughter and intercultural differences: www.becker-asano.de/HowAboutLaughter_ACII2009.pdf.

[139] Masaki Fujihata ed., *Can Humanoids become human?, CREST symposium report "Creating a 21st Century Art Form Based on Digital Media"- interviews* (Tokyo 2008).

machine interaction.[140] At the Device Art Symposium at Ars Electronica 2009, researcher Hideyuki Ando (who has collaborated with Junji Watanabe in the development of several haptic interfaces) speaks about his work as "sensation research". Just like Watanabe he is interested in a better understanding of the encounter of the human being and an electronic interface. He goes as far as to designate his work with the term 'artwork', through which he wants "to understand the nature of humankind". Coming from an engineering background, his efforts are focussed onto "investigat[ing] how technology can change our perception".[141]

Aims like these overarch individual activities in this area. Reminiscent of statements from decades of media artistic activity, the central concern is to position engineering research between the development of technology (as its core incentive) and more creative approaches in an art context. For engineers like Ishiguro, Watanabe, or Ando, the media art sphere is not a field alien to their usual range of vision.

Linked to the world of commercial gadgetry, *the* model 'device artist' Nobumichi Tosa alias Maywa Denki addresses the art status of his works in a sober way: "First, I make art and then I make mass products." He refers to the distinguishing aspect of uniqueness versus mass-production and sells his company's products as offsprings of initial artistic creation rendered commercializable. "I make many nonsense machines, but this product is art – [there is] only one", he says pointing to one of his not (yet) mass-produced prototype pieces.[142] With science and technology lying at the center of it all, according to Tosa, later "media technology" was born, out of which developed "media content" and "pop culture".[143] The interrelation of media art and technology, or rather technology as the prerequisite of media art, merges with Japan's popular culture into what Japan's government recently has widely been promoting as its 'contents industry'. The Japan Media Arts Festival or proposals like the establishment of a National Center for the Media Arts by the former government of prime minister Taro Aso are appendices of this strategic promotion.

Maywa Denki exhibits mass-produced items; game consoles by Kuwakubo are tested by an art audience – both are called 'device artists'. Nintendo's newest video

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[140] Ibid., p. 10-12; see also critically: Johannes Auer, "Ganz die Alte. Eindrücke vom Ars Electronica Symposium 2009", *netzliteratur.net*, online source: www.netzliteratur.net/ars_electronica_2009.htm.

[141] Hideyuki Ando at Ars Electronica Festival 2009, Brucknerhaus Linz, Sept 4, 2009.

[142] Tosa at the above-mentioned symposium at Ars Electronica 2009, Brucknerhaus Linz, Sept 4, 2009.

[143] maywa.laff.jp/blog/2009/07/post-2e9a.html.

games are accessible to the general public at the main square in Linz, Austria, while engineering research like the one by Watanabe or by figurehead Ishiguro attracts curiosity at international media art festivals: Japan's technology is well represented in the global media art context, not by media art pioneers like Masaki Fujihata or Teiji Furuhashi, but by researchers of the national telecommunication company, or of the Intelligent Robotics Laboratory at the University of Osaka. Engineering research as well as gadgetry next to more traditional media artworks all become Japanese 'cultural exports'. The notion of a culture-related export is not just linked to economical matters, but also to the aforementioned notion of soft power. Usually cited in the context of 'contents' in a stricter sense (i. e. entertainment like television programs, motion pictures, video games etc.), these exports represent Japan internationally and in doing so are perceived as "image-boosting cultural-propaganda agents".[144] Media art becomes an associate of technology and the industry in a society in which the latter two play a considerable role for its economy.

Media Art Networks in Japan

The media art scene in Japan is as diverse as any media art scene in the world. The focus I have chosen in this chapter conceals many technology-based art projects of Japanese artists and curators that have for a long time been active in an environment different from the one sketched above. Already in the 1980s, pioneers like Masaki Fujihata have been important actors in the international media art scene with early works like *Mandala 1983* or *Forbidden Fruits*. Yukiko Shikata, chief curator together with Kazunao Abe at the former Canon ARTLAB and later senior curator at NTT InterCommunicationCenter in Tokyo, has been promoting international exchange in media art ever since the beginning of her activity in the field. She has staged early projects by Fujihata as well as artists like Toshio Iwai, Seiko Mikami or Teiji Furuhashi. The spotlight of this chapter has been on the media artistic activity and institutions in Kantō area around Japan's capital Tokyo. It would be painting a distorted picture if one were not to mention major sites of media art promotion outside of this area, like the International Academy of Media Arts and Sciences (IAMAS) in Ogaki City launched in 1996, or the Yamaguchi Center for Arts and Media (YCAM)

[144] Nissim Otmazgin, "Japanese Government Support for Cultural Exports", *Kyoto Review of Southeast Asia*, No. 4, Oct 2003, online source: kyotoreview.cseas.kyoto-u.ac.jp/issue/issue3/article_296.html.

established in 2003. Both places are important breeding grounds for media art and its proliferation not only in Japan, but also internationally.

Nevertheless, I am trying for a general assessment of a specific setting in the current media art scene in highlighting certain phenomena – by observing Device Art and its institutional entanglements as a "new art form", by more closely looking into the structural set up of Japan's annual Media Arts Festival, and by scrutinizing the involvement of technology agencies or the industry in this context. In doing so, I am hoping to pinpoint two interrelated aspects: how Japan offers singular conditions in the local support for media art on the one hand, and how actors position themselves in an art field according to their institutional obligation, their personal biography, and their professional stance. The interrelation of the two facets lies in the fact that the actors' positioning is reflected in a specific discourse overarching industry, technology agencies, the ministry of education, and art centers. This discourse is epitomized in the linguistic dichotomy of 'media art' and 'the media arts' – or 'media art' and 'media geijutsu' in the festival's sense.

How do a new art term and the academic promotion of media artistic approaches correlate? What does Device Art, an art form perceived or promoted as characteristically Japanese and rhetorically traced back to the early Japanese crafts tradition, have to do with engineering departments that foster creativity by their students and exhibit research at art festivals? An important reason for this correlation has been found in the promotional structure for arts and technology. There is strong evidence that terms like Device Art and institutions like the Japan Media Arts Festival are the fruit of a funding situation that is itself linked to economic strategies, notions of soft power, and cultural exports. I have observed and described the media art scene in Japan (or rather certain peculiarities) in a study of its institutions and actors within given frameworks and thus attempted to display mechanisms at work that lead these actors to take on specific positions – discursively and actively. In doing so, I follow the sociologist Stephan Fuchs' reflections on actors and networks. I apply them to a particular case study in order to fill them with concrete content.[145] Fuchs' argumentation, perceiving sociology as *the* tool to contribute to the debate on essentialism, is based on the awareness that everything is observer-related and on the

[145] Cf. Fuchs 2001.

consequences arising from that. In spite of several shortcomings of his approach,[146] especially his analysis of networks within the arts is of vital significance for my understanding of a sociology of art targeted at unveiling structures and constraints in 'the art world'.

Taking an art sociological stance, one has to keep in mind that one always runs the risk of oversimplifying interrelations and of constructing chains of cause and effect that cannot mirror any reality in all its complexity. It is not my wish to present the behavior of individuals as merely linked to and explicable by apparent 'structures'. This would imply an author's arrogance to deprive the observed of free choice and purposeless acting. "By focusing on sources and choices, there is no longer the vague imprecision of 'influence' or the suggestion that an artist has responded passively or mechanically in a cause-effect scenario."[147] Rather, I understand phenomena of media art in Japan by highlighting protagonists' choices in a field of inevitable power relations and (strategic) positioning.[148] Art forms like the newly launched Device Art thus become identifiable as born out of conditions in which networks matter. Individual and corporate actors are not tossed around by incidences, but deliberately take action and position themselves rhetorically. The scene is set by individuals (like Machiko Kusahara, Ryota Kuwakubo, or Hiroo Iwata), by corporate bodies (like the Japan Technology Agency), and by places (like Miraikan in Tokyo or Ars Electronica Center in Linz).

"What sociology can do […] is observe how social structure works in art. This involves switching from 'what' to 'how' questions, from 'what is art' to 'how is the art that is already there made, displayed, produced, and understood,' or 'how does a novel art distinguish itself from previous art.' Such how questions overcome essentialism, since the interesting problem is now to explain variations in arts as the result and outcome of networks."[149] Machiko Kusahara mentions the enormous importance of the network in Device Art as a newly established art form. The current success of the term itself and of the artists and curators involved has been greatly due to "key persons,

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[146] Fuchs stays vague and general in a lot of his observations. Problematic is also the rather unsatisfactory definition of what he is talking about when he uses the term 'culture' (p. 155-164), as well as his diffuse conception of 'art' versus 'aesthetic culture' (esp. p. 165-168).

[147] Linda Dalrymple Henderson following Michael Baxandall, "Editor's Introduction: I. Writing Modern Art and Science - An Overview. II. Cubism, Futurism, and Ether Physics in the Early Twentieth Century", *Science in Context*, Vol. 17 (2004), No. 4, 423-466, p. 437. See also p. 436-439.

[148] Cf. Glauser 2009, esp. p. 20-27.

[149] Fuchs 2001, p. 167.

mostly academic, with backgrounds such as engineering, media and art, collaborat[ing] for many years to persuade the ministries and their agencies".[150] According to Carla Diana, it is these efforts that finally disembogued in governmental support for enterprises such as the CREST-funded Device Art project or the Japan Media Arts Festival.[151] Quite contrarily, my aim is to point out how such efforts are not merely the cause of a handful of individuals' ideas, but rather are interrelated with political decisions and strategies. I have shown that curators, engineers, and artists alike all convene under one label – Device Art – which enables them to pursue various ends to their professional benefit. While cultural funding in Japan is not abundant (especially for contemporary, 'non-traditional' art),[152] Device Art has proven a niche attracting funding not only from art-related sources, but also from technology agencies like JST. As such, it is displayed at Miraikan – a science museum, and at Ars Electronica – an art festival. The Device Art section at Miraikan can be seen as a showcase of Japan's efforts in interrelating creativity (or 'art') and technology. The ostentatious focus on entertainment seems especially compatible with the 'hands-on' approach of the museum. Commercializable art shown at a science and technology museum exemplifies one facet of the omnipresent role of technology in Japan. A press release of the University of Tsukuba celebrates the section at Miraikan as "express[ing] technology in visible form through making full use of mechatronics and material technology".[153] In every contribution to the debate on Device Art, the fusion of art and technology is traced back to a 'Japanese tradition' of incorporating functionality (and proto-technology) in works of craft and art.

In his paper on the culture of technology in Japan, Masataka Baba mentions the stunningly high level of crafts in pre-Meiji Japan and the simultaneous lack of scientific thinking and "mechanical technology".[154] He refers to *wasa*, or a practical

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[150] Kusahara cited by Carla Diana, "Device Art: Coming to America?", *Core77. Design Magazine & Resource*, online source posted Jul 3, 2007: www.core77.com/reactor/07.07_deviceart.asp.

[151] Ibid.

[152] In the Fiscal Year of 2005, the budget for the Agency for Cultural Affairs equalled 101.6 billion yen, i. e. 0.22% of Japan's GDP (comparing to e. g. 0.35% in Germany). The percentage of these 0.22% going into the Promotion of Arts and Culture of 'non-traditional arts' was about 35%. Cf. www.bunka.go.jp/english/pdf/chapter_01.pdf.

[153] Dating April 2008, www.tsukuba.ac.jp/english/topics/20080620092129.html.

[154] Masataka Baba, "Skill and Intuition. A new technology culture at the intersection of different cultures.", in: Ian Inkster and Fumihiko Satofuka, eds., *Culture and Technology in Modern Japan* (New York 2000), 23-43, p.25.

and intuitive knowledge as constituitive for Japan before the Meiji Restoration.[155] Baba's reference to a tradition of handcraft and the emphasis on practical usefulness in Japanese goods alines well with governmental reports on the one hand, and the overall consensus at the symposium 'Media Arts supported by technology' in February 2009 on the other hand. The Japanese Ministry of Economy enunciates its aim to "ensure a leading position for Japan in world markets […] by coordination cutting-edge technologies […] with traditional Japanese technologies, techniques, and craftsmanship".[156] A similar note is struck by symposium speakers Harashima, Moriyama, and Iwata when they all agree on the fact that 'industrial art' be a distinct cultural product of Japan. In their overall opinion, functionality has always played a significant role in Japanese art.[157] It is in this sense that the increased academic effort to promote creative approaches by Japanese engineering students becomes understandable. Not only is a "new art form" relying on (cutting-edge) technology displayed at a science museum. There is also an incessant demand of innovation in the development of technology (Miraikan is not accidentally entitled 'National Museum of Emerging Science and Innovation'). Media art here finds a stage beyond common exhibition spaces in the context of innovative technology. The academy, as seen above, is a crucial promoter of cross-disciplinary projects emerging from engineering departments. A well-working rhetoric is to invoke overcoming the gap between the arts and the sciences by creative research at the borderline of conventional disciplines – more than fifty years after Charles P. Snow's publication the idea is still the same: to bridge institutional divides in nowadays' gadget-society, this time with media art or engineering research in interface design. The long lasting dedication to such enterprises by figures like engineering professor Hiroshi Harashima offers evidence for Device Art's position in the field of "R & D"[158].

One might wonder how origins of Device Art – technology-based art today – be retraceable to 8th-century Japan. In their 'chronicle' of Device Art, Machiko Kusahara and Hiroo Iwata construct a historical line with reference to Japanese tea bowls, garden

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[155] Ibid., p. 26.

[156] Ministry of Economy, Trade and Industry 2004, p. 1.

[157] See above, footnote 112.

[158] 'Research and Development'; also notice the strategic enhancement of "industry-academia collaboration" through projects like the Research and Development Program by the Ministry of Economy, cf. Ministry of Economy, Trade and Industry 2004, p. 17.

design, and 'Kojiki', "the first book of Japanese history" mentioning the word 'mitate'. According to their reasoning, the tradition of mitate and its representation of a Japanese playfulness "contributes in bringing art outside of museums and galleries, enabling even commercial production and distribution of artwork to reach a wider public. […] Device Art rejects the traditional idea that draws a line between art and commercial products."[159] Device Art as well as the Japan Media Arts Festival are rendered exemplary of something genuinely Japanese. In statements like the one by festival committee member Yasuki Hamano on "a group of works to be 'media arts' from Japan"[160] we find a national discourse which is rare in the context of international media art. Playfulness as the prominent recurring theme brought up by festival and Device Art promoters is outspokenly connected to entertainment and thus – via commercialization – to the industry. As Hamano puts it quite blatantly, it is power and positions that are at stake here, also national ones. In the many sources around Device Art or the Japan Media Arts Festival, the two offsprings of current media art in Japan are indirectly or directly located in the strategic arena of the 'content' industry, which in turn is tied to 'cultural exports' and national 'soft power'. Even though Japan's status of an economic superpower has suffered a severe setback, its global cultural influence has not only been conserved, but even grown since the burst of its bubble economy around 1990.[161] "Japan Inc." is still the second largest economy of the world and within this economy, the 'content' industry is a rising factor as show ministry reports. It is all about the "ability to export culture to the world through contents industry".[162]

To improve the "techno-giant's" national image in the international battlefield of market forces, thus concentrating on its soft power by exports carrying cultural meanings beyond mere functionality, it does not come as a surprise that rhetorics in the art field are deeply interwoven with business strategies.[163] In Japan – a superpower not

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[159] The chronicle was published for the occasion of Ars Electronica Festival 2009, *Device Art @ Ars Electronica 2009*, exhibition flyer, Ars Electronica Center, 2009.

[160] See above, footnote 79.

[161] Cf. Douglas McGray, "Japan's Gross National Cool", *Foreign Policy*, June/July 2002, 44-54, p. 47-48.

[162] Ministry of Economy, Trade and Industry 2004, p. 2.

[163] Similar tendencies can be observed in China. Fending off the dominating Western critique, functionaries and intellectuals are struggling to regain sovereignty of interpretation on Chinese contemporary art for – at least partially – clearly economic reasons. "In China, contemporary art becomes a question of power.": Mark Siemons, "Gebt uns unsere Kunst zurück!", *Frankfurter Allgemeine Zeitung*, June 19, 2010.

by military potency or international aggression anymore, but by a flourishing economy due to technological leadership[164] – the 1960s and especially the 1970s saw a new self-confidence rising which resulted in an enforced discourse on national uniqueness, so-called nihonjinron.

As often stated, this discourse was largely connected to the economic boom years, however, it left its marks until today and the habit to essentialize 'Japaneseness' has not ceased to pervade travel guides, newspaper articles, and also academic writing.[165] In the 1970s, having overcome the shock after World War II, the now promoted Japonesque expanded onto "techno/comic goods and images".[166] While a "*new* Japanness" was launched around that time, ostensively for the EXPO '70 in Osaka, the construction of a Japanese essence was no longer caught within the constrictive dichotomy 'modern versus Japanese' that it used to be in the pre-war era.[167] Cutting-edge technology and innovative engineering became part of the national image. An essentialized Japaneseness which had always been instrumentalized by external entities (for example by the European or US-American definition of and taste for Japonica, or by Bruno Taut's eulogy on 'Japanese' architecture) had now long been internalized within the island nation. It seems that the nation as an 'imagined community'[168] has, due to the historical constellation of century-long seclusion, taken on numerous facets of an external gaze with which it was confronted after the opening of the country during Meiji period. In the following, the act of defining 'Japaneseness' has always been linked to the political.[169] Whatever the bearer of this Japaneseness might be – woodblock prints, architecture, comics, or robots – its construction resulted from an external gaze which had been rendered the own.[170] As such, nihonjinron is a reactional discourse and not separable from its confrontation with 'the West' (which in itself is oftentimes essentialized). "For Japanese modernists […] it is impossible not to

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[164] Cf. Isozaki 2006, p. 54 "This nation-state brought into being by the Meiji-Restoration came at last to be represented in its economy and technology, no longer by its traditions or culture."; see also McGray 2002, p. 47.

[165] Cf. Wagner 2009; Wagner shows nicely how a presumed 'Japanese' love of robotics has been instrumentalized by various institutions throughout the decades after WWII; also Befu 2001, especially p. 14.

[166] Isozaki 2006, p. 101.

[167] Ibid., p. 14; p. 56.

[168] Cf. Benedict Anderson, *Imagined communities. Reflections on the origin and spread of nationalism* (London 1983).

[169] Cf. Isozaki 2006, especially pp. 11.

[170] Ibid, p. 25, 50, 114; see also Befu 2001, p. 6.

begin with Western concepts. That is to say, we all begin with a modicum of alienation, but derive a curious satisfaction […] when Western logic is dismantled and returned to ancient Japanese phonemes."[171] The architect Isozaki, including himself in his observation of the discourse on the 'Japanese', refers to the method of comparing Western concepts to Japanese ones, of retracing the 'Japanese' today to "ancient Japanese phonemes and concepts for their imaginative roots".[172] We encounter this also in Yukiko Shikata's statements on epistemic and communicational aspects, as well as in the debate around the concept of 'geijutsu' versus 'art'.[173] Observing an ever-existing gap between Western concepts and Japanese thought, Isozaki speaks about the "imperfectability of translation and at last the virtual impossibility of any real cross-cultural communication".[174] It is this predicament which surfaces in the debate around a 'Japanese' Device Art and the Japan Media Arts Festival.

If Device Art can be perceived as a cultural export *from* Japan today, the concept of 'art' is one that was imported *to* Japan in the late 19th century. As such, any debate on the status of art is related to the outside, a Western standard. Hence, the observed reactional discourse in media art results from a concept of thought alien to whatever beautiful artifacts were called, how they were perceived, or appreciated before the introduction of the words 'bijutsu' and 'geijutsu'.[175] Whether more than one hundred years of 'art' in Japan have by now been completely incorporated into the Japanese mind set is an issue impossible to dissolve; there remains reason for doubt. Curator Yukiko Shikata admits the growing presence of a 'Western' understanding of art, yet decidedly points to divergences when she claims that "the tradition of art in society is [still] totally different".[176] In the debate of this problem, once again, one is confronted with the risk of unduly essentializing a 'Japanese' uniqueness in dealing with 'art' on the one hand, and an indisputable discrepancy between 'art' and 'geijutsu' on the other hand. It is this discrepancy that Isozaki refers to when he speaks about the

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[171] Ibid., p. 65; also Befu 2001, pp. 35.

[172] Ibid., p. 68. Isozaki goes even further in his argumentation and, with Roland Barthes, in a semiologic approach denunciates the production of an "ahistorical nonplace" as the central issue of Japan-ness, p. 73-75.

[173] See above, cf. statements by K. Nagata, A. Wakimoto or A. Hosokawa.

[174] Isozaki 2006, p. 93.

[175] All the more so, since the sources analyzed in this chapter were all written in English, thus for an international audience, and since my interview partners were faced with a 'Western' interlocutor asking the questions.

[176] Shikata in interview with the author, NTT ICC, July 22, 2009.

'imperfectability of translation'. It is also this gap between stencil and image which reveals the worldwide hegemony of a 'Western' art concept remaining unchallenged.

In confrontation with an external gaze at international art venues, or even within the own country, justificatory elements enter the rhetorical presentation of a 'Japanese' media art form like Device Art. Time and again, protagonists of the art scene mention a Western criticism of Japanese media art.[177] A raised eyebrow due to a presumed lack of a social message in certain Japanese media art works, a criticism of their playfulness – the critique is based on the conception of art as autonomous, free of commercial aspirations, and linked to an understanding of 'high' and 'low' art as in what art should or should not do, be, represent. The Western rejection of a number of art works emerging from Japan is based on normative constraints safeguarding 'real media art' versus mere gadgets. Yet Maywa Denki's winning of Prix Ars Electronica in 'Interactive Art' in 2003 and the striking presence of Device Art and *Japan Game* in Linz for the occasion of the annual festival in 2009 stands for a broad acceptance of the appearance of game consoles and 'gadgets' at such festivals. At the same time, it symbolizes media art protagonist Christa Sommerer's and Laurent Mignonneau's call against an elitist and socially disconnected thinking in contemporary art which hinders innovative and interdisciplinary thinking.[178] In this respect, international tech-art venues like Ars Electronica and ISEA – and even more so SIGGRAPH with its trade exhibition and art show one next to the other – are also supporters of industry-related art enterprises.[179] While Device Art protagonists decidedly mention commercialization as an aim of their project, the underlying art concept completely opposes the one supported by the 'Western critique'. It is an understanding of media art as oftentimes closely interrelated with product design. Kusahara or Iwata do not elaborately refer to questions of design as they rather stress the link to technological development and the "manufacturing industry", but they do emphatically allude to the tradition of design in Japan.[180] Articles like Carla Diana's elucidation of Device Art, however, do discuss it

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[177] Cf. e. g. Ozaki 2005, p. 67; or Hiroo Iwata at 12th Japan Media Arts Festival, cf. symposium report, online source: plaza.bunka.go.jp/english/festival/2008/report/symposium/theme03/.

[178] Sommerer and Mignonneau 1998, p. 8. Also, in the face of a critique that this is not 'real' art, artforms like Device Art do not stand alone in the media art scene. On this problem of art's autonomy cf. below, chapter III, the section on *'Experience'*.

[179] Even Ars Electronica, initiated and sponsored greatly by the public hand, relies heavily on private sponsors like e. g. Microsoft, Silicon Graphics Austria, Siemens Nixdorf, or Ericsson Austria.

[180] Cf. e. g. Hiroo Iwata, "What is Device Art?", on the official Device Art website: intron.kz.tsukuba.ac.jp/vrlab_web/index.php.

in terms of art and design. In this case, the artwork is perceived as mass-produced and design-related, yet "guided by artistic vision rather than a corporate brand or market niche". The essential trait rendering it 'art' rather than mere commercial item is individual conception (just like Maywa Denki's 'prototypes') and the "producer's desire to communicate a message".[181] To the 'Western critique' of lacking a deeper message, the proclaimed message in the Device Art work becomes the mechanism itself: "The Device itself is content. […] Content and tool are no longer separable."[182] As such, the "nature of Device Art" is intrinsically linked to "elements of Japanese culture".[183] As such, it is also advertised outside of Japan.[184] Japaneseness seems catchy. The insistence on Japaneseness as a characteristic of this art is probably not insignificantly due to the Western concept of 'art' and its criticism of the entertainment focus in these artworks. In this, the open advertizement of Device Art as 'Japanese' at Miraikan becomes understandable as a reaction – otherwise Japaneseness would not have to be as prominent in a museum dedicated to universal science and technology.[185]

This said, it is important to point out once more that there is a wide range of media art free of any national discourse in Japan. Yukiko Shikata's curatorial projects or the works by artists like Masaki Fujihata are free of the specifically 'Western criticism', for they do not question the posited autonomy of the artwork by commercial aims and industrializability.[186] Nevertheless, the focus chosen here exemplifies how art takes on a role within an arena of technological development, of market forces, of political ends, and how it is nurtured by the overarching rhetorics of progress and power

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[181] Diana 2007.

[182] Iwata on intron.kz.tsukuba.ac.jp/vrlab_web/index.php.

[183] "[…] such as the importance of 'tools', the continuity between art, design and entertainment, and the importance of popular culture": Machiko Kusahara, "Why Device?", on the official Device Art website: intron.kz.tsukuba.ac.jp/vrlab_web/why.php.

[184] "Device Art a new form of art. It bridges art, design, technology, science and entertainment by using both the latest and everyday technologies, and by introducing elements in Japanese traditional culture." Exhibition description for Device Art at Ars Electronica Center, Linz, Sept 2009 – Feb 2010, on: www.aec.at/center_exhibitions_area_en.php?id=128.

[185] However, not far from the Device Art section, Miraikan also showcased Honda Inc.'s *Asimo* with daily presentations of the walking robot. Not surprisingly, as a national science museum, Miraikan does focus on Japanese accomplishments in technology and science.

[186] Explaining the two tendencies in current media art in Japan, Shikata herself refers to them as the "two vectors": "One is the vector which will create new expression based on the speciality of Japan while driving these forward [i. e. the artworks subsumed under the term Device Art], the other is the vector which opens a new view of world beyond the particular country as is Japan by introducing others' perspective." Embedding the current situation within the importance of an 'outside view' and the Japanese reaction to it, she also mentions the attractiveness of Device Art parallel to the popular notions of 'Cool Japan' or 'kawaii' culture. Yukiko Shikata, "Media Art in Japan – background and current situation", in: *New Media Archaeology*, exh. brochure, Shanghai eARTS Festival 2009, Shanghai 2009.

strategies. In this respect, Device Art does seem to "provide a key impetus to shaping our modern media-based society."[187]

A Glimpse at Historiography

In an international field of media art which claims to blur the boundaries between art, design, and technological research, Device Art is positioned as "avant-garde", "pushing the border of art"[188]. A label coined to discursively create a "new art form", Device Art serves as an instructive example of the emergence and ensuing consolidation of a media artistic entity. From an art historical perspective one might wonder what be the half-life period of such a construct – whether it will stay a temporary fad or immerge in a broader current of media art at the borderline of game items and entertainment. The author Carla Diana for example asks why with a huge American market in the "golden age for gadgets" Device Art in the US is still "relegated to museum boutiques and the back rooms of hipster Japanese toy stores".[189]

The very 'Japaneseness' of Device Art raises the question of any similar existence outside of the Asian island. Device Art curator Kusahara claims that in spite of it bearing "Japanese elements", it is "part of a worldwide phenomenon as well".[190] However, there seems to be no immediate link between the Japanese Device Art network and the *Device Art* exhibition which took place in 2004 in Galženica Gallery in Zagreb, Croatia. The title of the Eastern European show, turning into a triennial in 2006, has developed independently although roughly at the same time as Iwata and Kusahara were discussing the premises of their future CREST project. It spanned Croatian as well as Slovenian artistic contributions of electronic art. There was, however, no idea of commercialization of the artwork which is so constitutive of the Japanese concept. Rather, the European works were strongly conceptual in their approach. While the simultaneous appearance of a term in Eastern Europe and East Asia fosters the assumption that the time was just ripe for the 'device' in media art, 'Device Art' does not signify the same in both cases. Here, it is the title of a show of a diverse group of Croatian and Slovenian artists, there, it is a term which serves the creation of an 'art'. The question of historiographical consolidation is nevertheless not

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[187] www.aec.at/center_exhibitions_area_en.php?id=128.

[188] Kusahara on: intron.kz.tsukuba.ac.jp/vrlab_web/why.php.

[189] Diana 2007, online source.

[190] Kusahara on: intron.kz.tsukuba.ac.jp/vrlab_web/why.php.

only meaningful in the Japanese context. With the initial show in Zagreb turning into a triennial event, the two exhibitions following in 2006 and 2009 set up a European label of Device Art beyond a mere exhibition title – with striking differences to the Japanese one.[191] In 2006, Eastern European art was displayed alongside Californian robotic art; in October 2009, the invited contributions came from Device Artists from Japan and revealed remarkable differences of the two approaches.

Media art itself was, essentially in the 1980s and early 1990s, consolidated not always as part of, but oftentimes as parallel to contemporary art. A certain insecurity in the process of its calling into existence on an (art) historiographical level was and still is reflected in the multiple terms there are in order to describe and define (as in de-fining, setting boundaries to) the phenomenon: electronic art or techno-art, media art or new media art, from digital art to computer art and finally cyber art – there still is not a clear-cut demarcation of terms and their usage, even though media art has proven most successful as an overarching term.[192] The development of media art as a movement parallel to contemporary art relying on 'traditional' media becomes evident in the institutions hosting it – except for some video artists who have found their way into the canon of contemporary art, media art is still mainly exhibited in venues distinct from regular art museums. Ars Electronica in Austria, the Zentrum für Kunst und Medientechnologie (ZKM) in Germany, and little later the Canon ARTLAB as well as the NTT InterCommunicationCenter (ICC) in Japan, all these centers illustrate the institutional divide between media art and contemporary art. This divide is consequently also reflected in personnel and networks, in cooperations and discourses.

Conceiving media art as genealogically linked to avant-garde movements in the early 20th century is not unusual; indeed, the ennobling tag 'avant-garde' always works well as a marker of progressive difference. Also in Tokyo, ICC curator Shikata rhetorically bridges early 20th century collage art to 21st century media art, in this case to the Japanese duo exonemo formed in 1996 by Kensuke Sembo and Yae Akaiwa.[193] The apparent divide existing between technology-based art and 'traditional' art (from painting and sculpture to – accepted by now – installation art) explains the need to

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[191] Not unreasonably, curator Andreas Broeckmann sees complete contraries in the respective phenomena; cited after www.kontejner.org/device-art-3009-koncept-english.

[192] See also Michael Naimark, "Truth, Beauty, Freedom, and Money. Technology-Based Art and the Dynamics of Sustainability", report for Leonardo/ISAST, May 2003, p. 7, online source: www.artslab.net/.

[193] Yukiko Shikata in an interview with the author, at NTT ICC, July 22, 2009.

position the younger artform as more progressive. From a historiographical perspective, the efforts undertaken to consolidate media art as parallel to – for more future-oriented than – contemporary art are part of a necessity due to the lacking integration of technology-based art into the preexisting museological infrastructure. Equally part of this gap is the unbroken avant-garde belief in the maverick. The extraordinary, the future-vectored, the call for a new era have all been topoi from the very beginning of Ars Electronica in 1979 up to NTT ICC's current publications.

Not only Shikata and Kusahara see Device Art in direct succession of the avant-garde movements or the Bauhaus.[194] In his paper given at a round table discussion with Kusahara and Iwata in Zagreb, UCLA-professor Erkki Huhtamo elaborates on what he refers to as "proto-device art" in the 20th century. According to his argumentation, the logic inherent in nowadays' Device Art (in Japan) begins with the appearance of mass production in the late 19th century. Huhtamo then gives an overview of early 20th century art from Cubism to 1970s works by Nicolas Schoeffer, and depicts Marcel Duchamp, Thomas Wilfred, as well as Lázló Moholy-Nagy as "proto-device artists".[195] "There is a link that connects Duchamp with device art: Toshio Iwai's *Electroplankton* for Nintendo DS, a beautiful work. Actually, Iwai told me that this was his version of *La Boite-en-valise*. […] Just like Duchamp had created a miniture museum of his work, Iwai's *Electroplankton* is like a condensation of the works he created from the early 80s."[196] By constructing a filiation between a 2009 Nintendo game and Duchamp's work of the late 1930s, also here, Device Art is situated in an avant-garde context. These deliberations are the inscription of a recent phenomenon – Device Art – into art historical traditions. In doing so they render palpable the struggle to grant it a place in the 'sacred temple' of modernity. It is interesting to observe how deeply entangled nowadays' rhetorics are still with the prevailing rhetorics of the early 20th century. I will come back to exactly these questions in the third chapter of my dissertation.

Device Art as a niche of today's media art, Device Art as a booming temporary apparition – the Japanese model nicely serves as an example of the emergence of an art

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[194] Cf. Kusahara on: intron.kz.tsukuba.ac.jp/vrlab_web/why.php (Mar 2, 2010), also: Device Art, in: *Das neue Ars Electronica Center*, exhibition brochure (Linz 2009), p. 31.

[195] Erkki Huhtamo, "Proto-Device Art: A Western Perspective", paper given at a symposium at Device_art 3.009, Oct 27, 2009, Zagreb Center for Independent Culture and Youth; online source: www.kontejner.org/proto-device-art-english.

[196] Ibid. Huhtamo's line of argument ends in the question whether Device Artists in Japan today be able to benefit from lessons to be learned from "the dead-end encountered by proto-device artists".

historical construct, of the power of networks in the art world, and of media art historiography as well as its blanks. Before the coining of the term around the year 2004 there were the same artists, the same kind of works and inventions. Toshio Iwai, Maywa Denki, or Ryota Kuwakubo all were active in the scene without a summarizing technical term grouping them together as a 'phenomenon', or even a 'Japanese phenomenon'. The sudden appearance of the term Device Art therefore demonstrates how phenomena are being called into being with words. Whether the term will be a market label or rather encompass a style of art is too early to judge. Within the networks existing in the media art scene, who does and who does not find a place under the sun of the shining media art sky in the end depends on various factors. A big part of the outcome is reliant on authors, curators, and other participants of the discourse, who all help shaping the creation rhetorically. The longer Device Art gets more than 13,000 results on Google, the more it is likely to become canonized as a phenomenon in media art.

Taking a glance at historiographical aspects always means to question one's own writing. One of the most apparent pitfalls in this context is how to avoid my own nihonjinron. Describing phenomena happening in Japan does not necessarily render them 'Japanese'. My wish is to unveil certain occurrences as not having to do with an essential 'Japaneseness' at all, contrary to what various people advocate, and to describe others on the other hand as distinctly Japanese. It is a problem at the core of this approach which one has to be critically conscious of and I try my best not to fall into any all to complaisant essentialization.[197]

Media art in Japan, that is networks and individual actors within the scene, the emergence of defining terms and the appearance of perspicuous explanations, but also the instrumentalization of artworks and their authors, all this has been in focus of this analysis. Taking an art sociological stance and observing structural interdependencies runs counter to the romantic belief in an autonomous art. My interest here has

[197] Another issue that should not remain unaddressed in the context of historicizing this niche of media art in Japan would be a deeper discussion of the raised eyebrow within the Western hegemony of *the* conception of art. A different outlook on (media) art, due to different national parameters and values, concepts of the 'high' versus the 'low', of an elite versus mass culture – here we enter two fields which would need a more insightful discussant. One would be a comprehensive disquisition on the historical evolution of the concept of 'art' in Japan, with a special focus on contemporary art. The other would be debating the phenomenon of a Western critique of 'Japanese' (media) art in the context of post-colonial discourses and globalization.

apparently not been to take a look at media artistic works and analyze their content, meanings, or narrative structures. Rather, an in-depth analysis of a local infrastructure was supposed to lead to a better understanding of media art and how it is interwoven with other aspects of our techno-society. It is not only an illuminative example of art relying on the development of technology, but also of technological development being closely connected to artistic approaches, to creativity and unconventional perspectives. Technology is shaping our culture and influencing our every-day life. But technology is also being shaped by our culture in a steady back and forth.

II From Disenchantment to Re-enchantment

1. Of Silhouettes and Buckyballs

Monumental, fluorescent molecules waft across the wall. The room is dark and the bluish projection of the molecule models illuminates it only dimly. A slow, electronic soundtrack of melancholic beats fills the hall. A silhouette steps into the projection. With its shadow touching one of the particles, the particle begins to move slowly, distort, contract. The glowing elements are set in motion, though still swinging hesitantly.

What seems to be an entertaining set-up is actually a media artwork. The installation by media artist Victoria Vesna and nanoscientist James Gimzewski was created in 2002 and first installed at the Biennale for Electronic Arts in Perth that same year. The two professors at the University of California, Los Angeles, had met little before and started a collaboration leading to the creation of several artworks in the following years. Art met science, personified by two individuals interested in a sincere exchange between their two so disparate fields.

What is an artist's motivation in taking a step toward a world normally observed from a safe distance? Art and nanotechnology – where do the two intersect, if they intersect at all? A common remark in this context is that both, art and science, are two different approaches to what we call 'reality'. The former tries to open up our perception for an alternative reality, raises questions about the presumably 'known', and grants access to a world beyond every-day experiences. The latter, on the contrary, is dedicated to the exploration of the world in a different way. Scientific reasoning, the reproducibility of experiments, and normed methods of trial and error lead the scientist to eventually obtain a consolidated set of 'facts'. The 'facts' explain aspects of reality. When Vesna and Gimzewski developed *Zero@wavefunction*, questions about reality were brought to the fore, questions about our perception of the world, about matter and change.[198] However, the artwork addressing "energetic possibilities of particles" and Einstein's theory of relativity[199] does not come about in a sober attire. We encounter a spacious projection of so-called buckyballs in a dark room, immersed in the fluorescent turquoise light of the molecular structures moving about the wall, a most

[198] Victoria Vesna in an interview with the author, UCLA, March 9, 2009.

[199] Official text describing *Zero@wavefunction*, notime.arts.ucla.edu/zerowave/projection.html.

atmospheric lighting. The soundscape complementing the computer simulation of the buckyballs contributes to the ethereal ambience, with laggard bass beats underlying a sonic wavepattern. This is not science presented as dry subject-matter. This is science's mystic aura staged in a gallery space.

When the famous sociologist Max Weber coined the term the 'disenchantment of the world' around 1917, he pointed at the century-old process of intellectualization and rationalization that humankind had undergone, culminating in the rule of science and technology that was perceived as such and heavily debated in Weber's days. Not a greater knowledge of life conditions itself, but the *belief* in it, the belief that we *could* come to know everything, that there were no secret forces involved anymore, this is what characterizes the 'disenchantment of the world'.[200] One century later, science and media art team up in an auratic experience of monumental carbon molecules glowing in the dark. The gallery visitor can manipulate their shape and movement with his shadow. No disenchantment is to be felt in the museum space. One will rather feel quite enchanted by light and sound. The way scientific elements are presented in this 'nanoart' work reveals the often-cited "almost 'sacred' character of science"[201]. We marvel at gleaming icons of technoscience.

The marriage of nanotechnology and media art in *Zero@wavefunction* is part of the ongoing phenomenon subsumed by 'art and science'. In recent years, 'sci-art' and the number of related events and publications has enormously increased. BioArt, Transgenic Art, Robotic Art, Nano Art – it seems that not a lot of scientific fields have been too alien to artists. Be it phosphorescing bunnies, cloned trees, or artificially grown tissue, art has embraced life and technosciences alike and made them a *sujet* of their own.[202]

Institutional attempts to foster the exchange between artists and scientists are reflected in the establishment of artistic residency programs in laboratories of industry

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[200] Peter Lassman, Irving Velody, eds., *Max Weber's 'Science as a Vocation'* (London: Unwin Hyman 1989): Weber's original lecture of 1917, p. 13.

[201] Richard Whitley, "Knowledge Producers and Knowledge Acquirers. Popularisation as a Relation Between Scientific Fields and Their Publics", in: Terry Shinn, Richard Whitley, eds., *Expository Science. Forms and functions of popularisation* (Dordrecht et al. 1985), 3-28, p. 21.

[202] Among the vast literature on the topic see e. g. Stephen Wilson, *Information Arts. Intersections of Art, Science, and Technology* (Cambridge MA: MIT Press 2002); by the same author *Art + Science Now* (London: Thames & Hudson 2010). Also Susanne Witzgall, *Kunst nach der Wissenschaft. Zeitgenössische Kunst im Diskurs mit den Naturwissenschaften* (Nuremberg 2003); Ingeborg Reichle, *Art in the age of technoscience: genetic engineering, robotics, and artificial life in contemporary art* (Vienna 2009).

and academia. Certainly, art's flirt with technology and science began early on in the 20th century. Historiography is struggling to pinpoint the beginnings of any kind of interaction of the two spheres (though Leonardo Da Vinci would be the first icon called upon from a time long bygone). It is impossible not to mention Marcel Duchamp's importance in this context, as he liberated the artwork from medium-specific constraints and consequently introduced the *concept* as artistic essence in the 1910s.[203] László Moholy-Nagy's *Telephone Pictures*, another common example, were created in the 1920s. However, these paintings executed according to instructions via the telephone may well have involved the new medium of communication as a constitutive part of the work's genesis, but technology was not part of the artwork itself. After early computer music performances in the 1950s, the 1960s brought about a much more incisive cooperation of art, technology, and science, with the launch of *Experiments in Art and Technology* (E.A.T.). Engineer Billy Klüver and artist Robert Rauschenberg founded E.A.T. in order to "expand the role of the artist in contemporary society and eliminate the separation of the individual from technological change"[204]. E.A.T.'s efforts focussed on bringing together artists and interested scientists and engineers and culminated in the all-encompassing *Pepsi Pavillion* at the EXPO 1970 in Osaka, Japan. The enterprise ran parallel to the curatorial trend of the late sixties and early seventies, staging several collaborative projects of art with technology. Within the framework of Klüver's and Rauschenberg's endeavor there was a deeper artistic interaction with research laboratories of the industry, supporting an evolving tendency reflected by the inofficial artist residencies at Bell Labs in Murray Hill in the early 1960s.[205]

From that time onward, an active exchange between artists and scientists has been promoted by several artist-in-residence-programs; often by the industry, sometimes by academic institutions. The early predecessors were followed by Canon Inc.'s ARTLAB in Tokyo running from 1990 until 2001. Xerox Inc. started their Xerox PARC artists-in-residence program (PAIR) only little later, in 1993. But not only the

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[203] Cf. Dieter Daniels, *Vom Readymade zum Cyberspace. Kunst/Medien Interferenzen* (Ostfildern-Ruit: Hatje Cantz 2003), p. 7; Christiane Paul, *Digital Art* (London 2003), p. 13. See also Linda Dalrymple Henderson, *Duchamp in context. Science and technology in the Large Glass and related works* (Princeton: Princeton University Press 1998).

[204] Statement on E.A.T. set before the bastard title : Billy Klüver et. al., eds., *Pavilion by Experiments in Art and Technology* (New York 1972).

[205] For a concise depiction of technological development and the entanglement of military, industry, and early electronic art see Paul 2003, p. 7-25.

industry, also academia has been eager to strengthen the link between art, science, and technology. Worldwide, universities conceived programs embedding artists in lab environments – MIT's Media Lab in 1985, the University of Western Australia with its SymbioticA in 2000, or the Artists-in-Labs program at Zurich's University of the Arts in 2004.[206] All those activities have been aiming at supporting a mutual interest of artists, researchers, and engineers to cooperate and benefit from the collaboration.

Creations like Vesna's and Gimzewski's *Zero@wavefunction* thus do not come out of the blue. They originate from the context of a downright 'art and science' boom in recent years. Media art as an artform intrinsically linked to the evolution of the (applied) sciences has not only made use of technological accomplishment, but has also been addressing it ever since its beginnings. A myriad of media art exhibitions ("Art + Science"), festivals ("LifeScience"), publications ("Art and science"), and symposia ("Art and Science Now") are proof of the current incessant preoccupation with the subject.[207]

My interest here is to take a look behind the scene and illuminate aspects neglected by the art-sci discourse so far. As we will see, most protagonists in the field do not get tired of stressing the mutual fertilization of the two spheres, they employ recurring phrases that conjure the artist's creativity and science's need to embrace the arts' otherness. The topos of 'art and science' seems to be invented anew every year, recalling a bolstering tradition since Da Vinci. In the following case study of the emergence and characteristics of 'nanoart', I analyze one example of art palpating emerging technosciences.[208] A look at media art networks and the actors' adaptation to an institutional infrastructure give evidence of how and why this convergence of art and science has been thriving lately. This chapter on media art meeting the technosciences will complement the previous examination of art's rapprochement of research and technology in the Japanese context. We have seen how in a specific

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[206] See also various research programs of the British Arts and Humanities Council: www.ahrc.ac.uk/FundedResearch/Pages/default.aspx; and the Netherlands Organisation for Scientific Research, www.co-ops.nl. For an excellent overview of the numerous international programs and developments in this field see Michael Naimark, "Truth, Beauty, Freedom, and Money. Technology-Based Art and the Dynamics of Sustainability", report for Leonardo/ISAST, May 2003, online source: www.artslab.net.

[207] "Art + science : Sensitive Chaos", exhibition at NTT InterCommunication Center, Tokyo, July-September 1997; "LifeScience", Ars Electronica Festival 1999; Siân Ede, *Art and science* (London: I.B. Tauris 2005); "Art and Science Now. The Two Cultures in Question", symposium at Tate Modern, London, January 24, 2009.

[208] Or, to say it with Adorno: I wish to analyze how and why art – operating with something "in keiner meinenden Sprache Aussprechliche[m]" – approaches the 'rational' sciences.

environment in Japan actors position themselves strategically with their art in a funding context. The employment of common rhetorics grants cultural networks a significant amount of coherence.

In this chapter the focus is no longer set upon art's presence in the field of technological development but on artistic endeavors in the scientific community's periphery. Why are artists inclined to draw near to science, all the more 'cold' technosciences like nanotechnology? Are the outcomes of this artistic interest works of poetic surplus, or does art here serve as a vehicle of scientific knowledge? What are the specific contexts in which the artworks are produced and later exhibited? My approach here is threefold. Like for the Japanese case of Device Art, I take a perspective leaning toward a sociological inspection of actors, places, and networks in order to better understand art in the science context as well as its interrelationship with creators, promoters, and sponsors.[209] With an interest in *actors* and their position in the field I will discuss aspects of 'art and science' beyond the conventional reference to interdisciplinarity and to the generation of "new forms of knowledge". The observation of actors in the scene will secondly be interwoven with an in-depth analysis of the *objects*. It will highlight the technoscientific background informing the artworks by resorting to insights of science studies and Visual Studies and thereby will also for example touch upon the workings of atomic force microscopes or nanotechnological image production relevant for this context. Science's preoccupation with invisible spheres will reveal the artworks' devotion to the tactile sense. A final concern of this chapter is to take a glance at the artists' recurring invocation of science's apparent opposite – mystery and spirituality. This will raise the question of deep-rooted cultural and historical implications of the artistic phenomenon 'art and science'.

The 1990s: Nano in Linz, Micro in Berkeley

"The grid of here and now becomes more malleable. Virtual reality, interactive computer installations, endophysics, nanotechnology, etc. are technologies of the extended now, of the non-local here, (remotely correlated) ways of transcending the local event horizon. All of this represents a technology that frees us from the letters [sic!] of reality."[210] Twenty years ago, Peter Weibel contemplated the relationship

[209] See the first chapter, esp. p. 16.

[210] Peter Weibel: "The World from Within – Endo & Nano. Over and Beyond the Limits of Reality", in: Karl Gerbel, Peter Weibel, eds., *Die Welt von Innen - Endo & Nano / The World from Within – Endo &*

between emerging technologies and their impact on our perception and the location of our selves. Their common defining term 'technological' led the media theorist to position nanotechnology and interactive art side by side. A euphoric tone in the 1992 catalogue text proclaims a vision close to fulfillment. All is set in motion, Cartesian constraints are finally about to be overcome, reality is no longer agonizingly binding. We approach the 'now' and the 'here' – time and space – from a completely different angle now, it is as if our outlook upon the world was radically altered forever.

The media art festival Ars Electronica in 1992 was centered around two surfacing technologies which served as a springboard in exploring various aspects of the entanglement of art and technology. Endo ('inside') and nano ('dwarf'), two greek radicals, not only constituted the festival's title. They also opened up a wide field of associations, ground for reflecting upon human perspectives and constructions of reality. Media artistic endeavors reached out to high-tech. Three years after physicist Don Eigler's ground-breaking success of moving single atoms to spell out the letters 'I B M' on a nickel surface, the buzzword 'nano' had made it to Linz. The air was full of nearly tangible science fiction, K. Eric Drexler had published his visions of molecular nanotechnology and the 'grey goo', leading artists and theorists like Weibel succumbed to emphatic eulogies of a changed present.[211] The works that were shown within the framework of the art venue included interactive installations, real time video feedback systems, telepresence, and electronic music. Some referred to endophysics and addressed the 'observer's standpoint' by integrating sensors and distortion into their video systems. However, a discussion of endophysics and nanotechnology took place in the textual dowry of the catalogue rather than in the artworks themselves. There was not a single piece that attempted to conceptualize nanotechnology in an artistic way.

In 1996, engineering professor Ken Goldberg of UC Berkeley and graduate student Karl-Friedrich Böhringer, Cornell University, cooperated on what eventually became an artwork: *The Invisible Cantilever*, or just *flw*. Observed with the unaided eye, *flw* is

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Nano, exh. cat. Ars Electronica [Vienna] 1992, 8-12, p. 11-12. The German original text uses the word "Gitterstäbe" translated with 'grid' here, connoting rather something like 'lattice bars' than grid.

[211] In his introductory remark, Weibel cites Drexler as sole source on emerging nanotechnology, referring to the latter's 1986 novel *Engines of Creation*: ibid, p. 8. Drexler himself contributes a vision of possible future nanotechnological applications to the art festival's catalogue: K. Eric Drexler: "Under special conditions, chemistry can build stable nanostructures", in: Gerbel/Weibel 1992, 74-78.

merely a silicon chip of not even an inch's width. Cutting-edge technology of that time inspired Goldberg and Böhringer for this microelectronic bricolage: to etch a minuscule model of Frank Lloyd Wright's Fallingwater House out of a silicon surface. The outcome of the engineers' jest – a one-to-onemillionth-scale model of the famous architect's masterpiece – was soon to be exhibited in art contexts.

In order to perceive the "artwork that can't be directly experienced by the body"[212], the gallery visitor has to direct his gaze through a microscope. The tiny ultra-high precision lithography consequently becomes a voluminous installation piece. It is composed of a wooden pedastal holding the optical microscope with the silicon sample and a black and white photograph of the silicon etching. The wall-mounted picture of *flw* indicates the scaling, rendering it clear that it shows a magnification of the exhibited microstructure.

What led the engineers Goldberg and Böhringer to produce this finicky piece while they were usually occupied with using the same technique to etch out tiny robot arms for their research? As explain the authors, Wright employed the static principle of cantilevers in the construction of Fallingwater's balconies in 1936. „[C]antilevers are [also] used to measure forces in miniature devices etched from silicon. Examples of current research can be found at many labs including UC Berkeley, Cornell, and UCLA."[213] This analogy of cantilevers in architecture and microelectronics induced the team of researchers to first transfer the original architecture's structure into a simplified model, then apply a technically highly elaborate method on the silicon surface until revealing what today's gallery visitor can marvel at through the microscope.[214] Employing the method of silicon etching that was used by Goldberg and his team it hardly would have been possible to obtain smaller dimensions in 1996.

There is a technique; there is a research team willing to invest their time playing about with microelectronic appliances; there is space left for creativity – and a semi-conductor chip is transformed into an artwork. What Goldberg presents to the public is a silicon model created by state-of-the-art technology. He also describes the model's

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[212] Peter Wayner: "House Hunters. 8 Rooms, 4 Baths, No Vu", *New York Times Magazine*, March 10, 1996, p. 21.

[213] www.ieor.berkeley.edu/~goldberg/flw/.

[214] The genesis of the work as well as the processes of ultra high precision lithography and "Single Crystal Reactive Etching And Metallization" are shortly explained in the installation's accompanying text as well as on Ken Goldberg's website, ibid.

genesis as a constitutive part of the work. Known to the media art public for his 'telepresence' works, above all for *Telegarden* (1995), Berkeley professor and media artist Ken Goldberg adds another piece to his list of artworks, this time an interface between laboratory and art gallery.[215]

"If I had made it today, I would have loved the idea of doing it with nanotubes".[216] What can be called a micro artwork operated in dimensions one thousand times bigger than the atoms shuffled about by Eigler and his team at IBM Almaden Research Center in the late 1980s. Nanotechnology was still in its infancy at the time when Ars Electronica staged its annual festival under the title "The World from Within – ENDO & NANO" in 1992. But the buzzword 'nano' was already around. While Goldberg's and Böhringer's *flw* shows how 'architecture' at the micrometer scale was thinkable without having gone nano, scientists did not rest. "Made for fun to illustrate the technology", it was researchers from Cornell who presented their 'nanoguitar' in 1997 – a tiny guitar-shaped silicon object, the size of a single cell.[217] Numerous nano 'sculptures' followed, made by scientists all over the world: from the 'nano bull' designed by researchers at Osaka University in 2001 up to David Cox' 'nano snowman' at the British National Physical Laboratory in 2009.

All of these tiny semiconductor carvings range somewhere between high tech bricolage and the promotion of research. Highly persuasive images of raging bulls and cute snowmen quietly advertize the research teams' skills and active accomplishments. The images are often effectively manipulated, as show section, coloring, and the 'snow' in Cox' figure. Certainly, neither the Osaka researchers nor the British nanoscientist claim to have created art. Contrary to Goldberg, they do not present their creations in the art sphere. Yet they illustrate the context in which the scientific and technological merge with the representational and figurative.

Goldberg's and Böhringer's work, which ten years later might have been done with nanotubes, gives evidence of the 'anything goes' in media art. Among other places, it was exibited at New Langton Arts in San Francisco in 1997, 2005 at the science museum Exploratorium in San Francisco, in 2008 at Cartes Centre for Art and Technology, Tapiola, Finland. In 2007, it was part of an exhibition entitled "Territoires Invisibles" at the Maison Européenne de la Photographie in Paris. Here, other 'nano'

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[215] See Reichle 2009, p. 134-137.

[216] Ken Goldberg in an interview with the author, UC Berkeley, March 2, 2009.

[217] www.news.cornell.edu/releases/july97/guitar.ltb.html.

artworks kept it company: *200_nanowebbers* by the artistic duo Semiconductor, *Nano-Scape* by Christa Sommerer and Laurent Mignonneau, and also *Nanomandala*, another work by Vesna and Gimzewski. "Territoires Invisibles" was organized within the annual festival "@rt Outsiders" which is dedicated to contemporary creation and its link to science and technology.[218] It presented explorations of the "infinitely small" and asked questions about "parallel and immaterial worlds that surround us and the mental images that our imagination forms".[219] *flw* was included as a demonstration of the incredibly small scale at which contemporary technology operates, as a "reappropriation of art through science". The press text speaks of the invisible and the potentially immense merging in this work.[220] With *flw* and the other pieces, the show staged art that broaches the issue of nanotechnology while the intellectual superstructure of exhibition and works alike addressed more 'philosophical questions' inherent to the subject matter. It was all about "confronting our point of view", the "inexhaustible imagination" of "parallel worlds", and "unsettling our coordinate system".[221]

Fifteen years after "ENDO & NANO" in Linz, nanotechnology was still appealing to art curators. It is striking how similar the metaphors employed in the catalogue texts were, how core motifs around the subject matter were not altered by a lot. The utopian potential of nanotechnology presumably shattering our world view was invoked once more. The impenetrable depths of new 'worlds', worlds beyond our perception, were addressed with wonder. Nanotechnology still served as a trigger of fascinating fiction and a projection screen for the marvels of poetic approaches. Although a weak term, an artistic niche, and everything but coherent, there was something called 'Nanoart' now.[222]

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[218] "Créé par Henry Chapier et Jean-Luc Soret en 2000, le Festival @rt Outsiders est une manifestation annuelle consacrée aux nouvelles formes de la création contemporaine et à leurs rapports avec les sciences et les technologies", www.art-outsiders.com/archive_2007/index.html.

[219] Ibid.

[220] "À cette échelle, le potentiel, invisible à l'œil nu est immense.", press release, Festival @rt Outsiders 2007, Maison Européenne de la Photographie, Paris, p. 3.

[221] Ibid., p. 1.

[222] Nanoart (and its orthographic variations NanoArt or Nano Art) today is a label designating highly heterogeneous phenomena from pictorial achievements in the nanoscientific community, new-age-style manipulations of those research images, and finally media art installations. Only the latter will be discussed here. Most of the artists understandably resist any classification under this label. I shall still use it here for reasons of practicality, without any intention of consolidating a new art historical term compartmentalizing artworks that might well be classified differently. For plentiful other ‚Nano Art', not seldom appearing with a certain educational mission, see for example NanoArt International Online

> „[...] Gimzewski opened his lab to Victoria Vesna and together they initiated a number of projects whose goal is to make nanoscience more accessible and understandable to the broader public.“[223]
>
> "We [artists] have always played a role in introducing the general public to new ideas […]."[224]
>
> "This is something that brings science to all kinds of people."[225]

Soon after Vesna and Gimzewski had met at a conference they began their ongoing collaboration. The artist was interested in nanoscience, the scientist shared her interest in opening up toward more philosophical approaches. A multifarious outlook on the world became the intersection of art and science in the artworks that the two created thereafter. Thinking about the reality that surrounds us, about the matter of things, the invisible – Vesna's motivation in collaborating with a scientist was not to be "in service of the science. […B]oth of us are ultimately interested in larger philosophical issues that nanotechnology brings up. So it's *not* about nanotechnology."[226]

That works like *Zero@wavefunction*, *Quantum Tunnel*, *Blue Morph*, or *Nanomandala* are not about nanotechnology when nanotechnology is the backbone of every one of them is a rhetorical dart sideways that needs illumination. Vesna's understandable refusal to be 'in service of the science' is something we encounter often in the art-science context. It will be helpful to throw a glance at this context, at the 'who' and the 'where', in order to understand the 'why' of contradiction and conflict. If the media artist posts didactic goals on her work's website, then refutes educational aims in an interview, if 'nano' is a recurring prefix within the framework

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Competition - www.nanoart21.org; cf. critically on this Sarah M. Schlachetzki, "NanoArt International Online Competition", in: David H. Guston, ed. *Encyclopedia of Nanoscience and Society*, Vol. 2 (Thousand Oaks: Sage Publ. 2010), p. 451-452. My dissertation does not incorporate an analysis of the art represented in the competition, like Chris Robinson's pictures that are dedicated to *images* in nanotechnology.

[223] notime.arts.ucla.edu/zerowave/zerowave.html, official website of *Zero@wavefunction*.

[224] vv.arts.ucla.edu/publications/publications/02-03/Artmedia/ARTMEDIA%20VIII%20-%20PARIS%20-%20Victoria%20VESNA.htm, website of the artist.

[225] James Gimzewski cited on www.dailybruin.ucla.edu/stories/2003/feb/4/nanotechnology-inspires-joinin/.

[226] Victoria Vesna in an interview with the author, UCLA, March 9, 2009.

of her installation pieces when they are at the same time "*not* about nanotechnology", it is valuable to analyze what they are actually about.

Victoria Vesna can refer to an artistic activity of over thirty years which includes video works, performances, and multimedia installations, but it is her nano projects in collaboration with James Gimzewski that have achieved great attention lately. There have been a number of exhibitions presenting those works, also bigger shows co-produced by the two UCLA professors themselves (not surprisingly entitled "Nano"),[227] as well as increased media attention. Finally, with its various events and activities, the *UCLA Art | Sci Center* which Vesna and Gimzewski established and preside over as artistic and scientific director, respectively, has contributed to their visibility in the field.

In 2002, they create their first work *Zero@wavefunction*, an interactive multi-media installation. For the "Nano" exhibition at the Los Angeles County Museum of Art a year later two more works are conceived: *Quantum Tunnel* and *Nanomandala*. A publication edited by literary critic N. Katherine Hayles accompanies the genesis of the exhibition, highlighting the background of the show. Finally, Vesna and Gimzewski produce *Blue Morph* in 2007, also an interactive and room-filling artwork, which this time incorporates images and sound sequences of nanotechnology. All of the multi-media installations have since been presented at various venues from biennales to art-sci exhibitions.

According to the work's description, the initial collaborative piece, in short *Zerowave*, "is based on the way a nanoscientist manipulates an individual molecule (billions of times smaller than common human experience)".[228] In the installation, large projections of molecular structures can be moved by the gallery visitor when she steps into the projection, pushes and contorts them, observes how the carbon particles behave in this monumental simulation. The ambience in the gallery space, immersed in blue with a slow beat enveloping the visitor, contributes to the orchestration of monumentalized icons of science. When in the 1980s the first fullerene was discovered

[227] The "Nano" exhibition was shown in LACMA, Los Angeles in 2003/2004 and at Museu de Arte Brasileira de FAAP in São Paolo in 2008.

[228] notime.arts.ucla.edu/zerowave/zerowave.html, official website of *Zero@wavefunction*. The work has first been exhibited in Perth in 2002, among others also at LACMA in 2003/2004 and in São Paolo, and has won the award for best art work at the Shanghai International Science and Art exhibition in May 2008.

by chemists due to the emerging nanotechnology, the shape of the molecule, resembling geodesic domes and soccer balls, led the scientists to name it 'buckminsterfullerene C_{60}', after the late architect and designer Richard Buckminster Fuller. Their neat form also seems to have inspired Vesna and Gimzewski to use the so-called buckyballs for their play with light and shadow. Sensors and computer simulation react slowly to the visitor's shadow pushing the particles. Slow movements show a greater effect of contorsion than abrupt ones.

The manipulation of the fullerene that Vesna and Gimzewski offer, however, happens on a merely symbolic level. That it obeys the 'laws of quantum physics', as insinuated by the São Paolo exhibition of the installation,[229] is simply not the case. There is no nanotechnology used, no nanoparticle altered; only a glowing projection of simplified molecular forms illuminates the gallery space. By mentioning the *magnification* of the molecules' scale as a central act of transformation, the Museu de Arte Brasileira comes closer to *Zerowave*'s core.[230] The analogy between the scientist's work in his laboratory and the 'manipulation' in the exhibition room more than anything is a metaphoric one. The visitor is exposed to a depiction of science as experience – "nano amplified to the human scale"[231].

With the name of the artwork as well as in the text describing it, the authors refer to Einstein and the interchangeability of matter and energy, to quantum mechanics and energetic possibilities of particles, to wavefunctions.[232] They also allude to Gimzewski's research at his UCLA Chemistry & Biochemistry Department:

> "How (the buckyball images) move is based on research that Gimzewski does, and based on actual movements of the molecules," Vesna said. "If you kick a ball, it jumps. But kick a molecule and it doesn't move – you have to hit it slowly." Similarly, "touching" the projected image of a buckyball with one's shadow will distort it, but moving too quickly won't affect it at all. "You are learning how the

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[229] "Um programa de computador permite a interação da sombra dos visitantes com esses objetos, modificando sua forma segundo as leis da física quântica.", www.faap.br/hotsites/hotsite_nano/interna.html.

[230] Ibid.: "Nesta obra, a escala nano foi ampliada para a escala humana.".

[231] Ibid.

[232] "Albert Einstein's greatest contribution to humanity is the discovery that matter and energy are inter-convertible. Matter appears, changes and disappears. Nothing is solid, not even a rock. The atoms and electrons in a rock are subtle and alive just as the ocean is. These particles are described in quantum mechanics by a complex function known as a wavefunction. A wavefunction contains all the probabilities and energetic possibilities of particles: $\Psi = \Psi$(space, energy and sometimes time). These wavefunctions are basically connected and when two come close, they are both changed. In fact they have a probability to create nothing: zero.", notime.arts.ucla.edu/zerowave/zerowave.html, official website of *Zero@wavefunction*.

> molecular world works," Vesna added. "The intent is not to teach. But it just does. It's another way of learning." Gimzewski hopes that generating more interest in science through art will make nanotechnology more tangible to the public.[233]

'Making nanotechnology more tangible to the public' is taken literally in this science-inspired artwork. The visitor can play about with the projected molecules, but the direct link to scientific processes or 'facts' remains marginal, even if she or he reads the given information on Einstein and electron probabilities. Rather, we encounter scientific icons staged monumentally in a work that is inspired by the fascination that science often exerts. The question is whether the piece really teaches us anything about nanotechnology – and which kind of 'philosophical issue' is actually brought to the fore.

Mise-en-scène of metamorphosis: Blue Morph

In 2003, Vesna and Gimzewski teamed up with literary critic N. Katherine Hayles (who at that time was professor of English at UCLA) as well as with the architects Johnston Marklee & Associates and started conceiving an exhibition entitled "Nano" at LACMA. Artworks by Vesna and Gimzewski and a multi-media installation by art graduate Anne Niemetz and Andrew Pelling, PhD student in nanoscience, were incorporated into an overall exhibition architecture. Hayles and her team of students contributed a compilation of quotes from science fiction and academic texts about nanotechnology. The publication "Nanoculture: implications of the new techno-science" edited by Hayles testifies to hot debates in the run-up of "Nano".[234] The efforts of everyone involved in staging nanotechnology and art were rewarded by the final show which was on display for almost a whole year in 2003/2004.

Critical voices asked whether "[w]ith all these malfunctions [of the electronic artworks] and children running around screaming inside the "Quantum Tunnel", do the little ones or even their adult counterparts understand the connections between nanotechnology and the exhibits?".[235] The press commentary points to a quintessential problem of any sci-art. Is this art in any sense didactic? If so, in which respect does it

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[233] www.dailybruin.com/articles/2003/2/4/nanotechnology-inspires-joinin/.

[234] Next to the supplementary material given by the book, it is especially Carol Ann Wald who offers an insightful account of the teams' struggles during the show's conception: "Working Boundaries on the nano Exhibition", in: N. Katherine Hayles, ed. *nanoculture. Implications of the New Technoscience* (Bristol und Portland OR 2004), 83-104.

[235] Rhea Cortado, "LACMA exhibit brings together science, art" [sic], *The Daily Bruin Online*, February 12, 2004, www.dailybruin.com/news/articles.asp?id=27390.

broaden our understanding of science and technology, or of philosophical matters? If not, what is it then about? Finally, how do we deal with the apparent gap between an 'ideal' user, an ideal impact of the artworks on the one hand, and the actual situation in a noisy exhibition space on the other?

A later edition of "Nano" in São Paolo in 2008 exhibited *Zerowave* next to *Blue Morph*, *Quantum Tunnel*, and *Nanomandala*. The show's title had been expanded to "Nano. Poética de um Mundo Novo". More evidently than the first artwork, *Blue Morph* has a connection to Gimzewski's research on oscillation and sound on the nanoscale. Varying in its set-up according to the exhibition space, the interactive installation works with semidarkness and dim blue lighting. With her presence, the visitor triggers a mechanism that activates sound, vibrations of the mat on which she is invited to sit down, and a projection. The projection shows highly magnified nanoscale images of butterfly wings. The soundscape is composed of amplified raw data files, obtained by Gimzewski and his team who observed low-frequency vibrations during the cellular change from pupa to Blue Morpho butterfly.[236] The artwork draws on nanoscientific research and at the same time reflects the biological metamorphosis of a caterpillar into a butterfly.

> Nanotechnology is changing our perception of life and this is symbolic in the Blue Morpho butterfly with the optics involved -- that beautiful blue color is not pigment at all but patterns and structure which is what nano-photonics is centered on studying. […] The optics are no doubt fascinating but the real surprise is in the discovery of the way cellular change takes place in a butterfly. Sounds of metamorphosis are not gradual or even that pleasant as we would imagine it. Rather the cellular transformation happens in sudden surges that are broken up with stillness and silence. Then there are the eight pumps or "hearts" that remain constant throughout the changes, pumping the rhythm in the background. During the transformation to emergence each flattened cell of the wing becomes a nanophotonic structure of black protein and space leading to iridescence.[237]

The text describing the piece offers background knowledge on images and sound in the artwork and on their meaning within Gimzewski's research context. In addition to the poetics of sound, lighting, and images in the multi-media installation, Vesna and Gimzewski list 'hard facts' of nanoscientific research. They mention atomic force (AFM) and scanning electron microscopy (SEM) and display data of spectral analysis on the website of the work. By referring to the technological use of Blue Morpho's

[236] Cf. artsci.ucla.edu/BlueMorph/concept.html.

[237] Ibid.

color properties for fabrics and monetary currency, the artwork is linked to science and research.[238] The interested visitor will be informed by brochures, leaflets, and web-sites, how this installation aesthetically arranges 'sonified' cell oscillation and microscopic lamellate patterns of butterfly wings. Yet while research findings seem to be carried into the gallery space, at a second glance they obviously serve as a vehicle to other levels of reflection.

According to Gimzewski himself, the nanoscale analysis of Blue Morpho pupa is not part of his fundamental research. Rather, while he and his team were doing experiments on the surface of yeast cells, they amplified the frequency of the cells' apparent motion, thus transforming raw research data into sound files within the audible spectrum. The idea to use the same equipment to record pupa cells during their metamorphosis into a butterfly followed little later. What had begun with the original intention to study cardiomyocytes turned into a scientific research paper,[239] an article on the discovery of cellular motion in the Smithsonian Magazine,[240] and finally, later, into the idea for an artwork.[241]

Anthropologist Sophia Roosth nicely illuminates how in the process of communicating their research on living cells the scientists begin to "describe cells as actors capable of 'speaking' or 'screaming'" and "how scientists use sound to represent these scientific objects as subjects".[242] The cells themselves do not emit any audible sound; they only vibrate. When Gimzewski denominates an increase in cellular vibration as 'screaming', Roosth appropriately identifies this ascription of agency as "anthropocentric". The yeast cell, the object of research, is endowed with subjectivity.[243] The metaphor of singing or screaming is effectively used by the scientists to "make sense of cellular noise" – noise which is a mere transcription of low-frequency motion in the first place.[244] Amplifying the cellular vibration is a way to render perceivable what is inaccessible at the atomic level. While the nanoscale

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[238] Ibid.

[239] Andrew Pelling et al., "Local Nanomechanical Motion of the Cell Wall of *Saccharomyces cerevisiae*", *Science*, 20 Aug. 2004, p. 1150.

[240] Mark Wheeler: "Signal Discovery?", *Smithsonian Magazine*, March 2004, online source: www.smithsonianmag.com/science-nature/Signal_Discovery.html.

[241] Gimzewski in an interview with the author, UCLA, March 9, 2009.

[242] Sophia Roosth, "Screaming Yeast: Sonocytology, Cytoplastic Milieus, and Cellular Subjectivities", *Critical Inquiry,* 35 (Winter 2009), 332-350, p. 333.

[243] Ibid., p. 339.

[244] Ibid., p. 333.

structure of the research object is invisible for us humans, the sound file creates an almost corporeal link between research object – yeast cell, and listener – researcher or layman. The "biological soundscape" that is created by Gimzewski and his team is then rhetorically enhanced with anthropocentric meaning and ideas of agency.[245]

Roosth's analysis acutely explores Gimzewski's yeast research and gives suggestive evidence of the cultural construction of meaning in scientific processes. The artwork *Blue Morph* represents yet another step in the mediation of research. When it comes to talking about the subjectivity of cells in the context of change from pupa to butterfly, the ascription of agency seems at first glance less problematic and offers – moreover – cause for awe and wonder in the face of nature's secrets. The data, peripheral to Gimzewski's fundamental research, produces files of "phantastic sound"[246] revealing cells 'talking' to us, this time from a pupa as a more developed being than yeast. *Blue Morph*'s basic idea – the lyrical exploration of metamorphosis and change – is a by-product of research enriched with poetic meaning.[247]

Blue Morph illustrates how the observer's perspective in science is intrinsically linked to immanent conceptions of subjectivity. Scientists often feel incited to think about philosophical components of their research findings and take a novel outlook on the 'meaning' of things. In *Blue Morph*, the philosophical 'surplus' of Gimzewski's research is turned into an artwork which merges awe-inspiring science and the poetics of being. As Vesna and Gimzewski underline in their statements, in this sense the artistic installation is "*not* about nanotechnology" but created to encourage a reflection on life and change. With its mystic blue lighting, the installation invites the visitor to sit down on a mat framed by LED lights. Touching the sensor board underneath the mat activates the sonorous soundtrack, vibration, and image projection onto the canvas-clad walls. A giant hat suspended from the ceiling completes the mise-en-scène. The big white piece of fabric that the visitor places on his or her head varies according to the installation space yet it always resembles the chrysalis of a pupa. Visitors to the piece most often assume an upright posture as if in meditation, many

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[245] Ibid., p. 346.

[246] Gimzewski in an interview with the author, UCLA, March 9, 2009.

[247] The research on pupa metamorphosis was later published in an academic journal, although done on the monarch butterfly, not the Blue Morpho: Andrew Pelling et al., "Dynamic mechanical oscillations during metamorphosis of the monarch butterfly", *Interface. Journal of the Royal Society*, 6 Jan. 2009, p. 29-37.

close their eyes.[248] The images that the authors disseminate of past installations of the piece depict people seemingly sunken into a meditative state.[249]

Blue Morph has been shown at the Centro Andaluz de Arte Contemporaneo in Seville, Spain, at Fringe Exhibitions Gallery in Los Angeles, or at Trondelag Centre for Contemporary Art, Norway. Twice, Vesna and Gimzewski exhibited their "Extraterrestrial Vibrations"[250] at the Integratron – a dome-shaped building constructed by the late ufologist George Van Tassel. Conceived as an alleged "energy machine"[251], the Integratron has hosted the epiphany of science and art's esoteric mélange. *Blue Morph* was installed for a one-evening event during which visitors lined up to take a seat on the responsive mat and be engulfed by the piece's lighting and sound. They came with expectations of a spiritual experience, anxious for meditation and an extension of their self.[252]

Both, Vesna and Gimzewski mention this 'spiritual' side of their art.

> But what's interesting is […] that [*Blue Morph*] – and this is the real belief I have, you know, it's a bit crazy – that when you have the right and the left hand sides of the brain operate and you can stimulate that in people it enhances a more ephemeral type of process and raises consciousness. […] And it's quite amazing that people come for change, they come to be surrounded by this sound and blue light, meditating on change. And I don't know why, it just happens that way that it is actually spiritual in a sense. And for many people that's unacceptable. So many people cannot stand the idea that you have science and art can contribute towards the spiritual experience.[253]

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[248] Vesna and Gimzewski express their surprise at the meditative posture the visitors assume. Gimzewski in interview with the author, UCLA, March 9, 2009; cf. also Claes Andreasson's radio broadcast and documentation on *Blue Morph*'s installation at the Integratron, in Landers, California: sverigesradio.se/p1/SRc/bluemorph/index.html.

[249] artsci.ucla.edu/BlueMorph/concept.html.

[250] "Extraterrestrial Vibrations" was the title of the event at the Integratron, situated close to Joshua Tree, California. The events took place in June 2007 and March 2008.

[251] The Integratron is commonly described as such by its adherents, as well as on the website of Fringe Exhibitions advertising Vesna and Gimzewski's staging of *Blue Morph* there in March 2008: www.fringexhibitions.com/mar08_2.html.

[252] "[…] the reason I came here is I'm just so excited about […] how that will transform my being in whatever way and I'm completely open to it. And I think it's gonna be an incredible experience."; "I just went into the *Blue Morph*. I was meditating before going in and the once I put the thing on my head I definitely felt more energy flow. I felt a connection. I felt it was a good energy.", visitor voices, radio broadcast and documentation on *Blue Morph*, sverigesradio.se/p1/SRc/bluemorph/index.html.

[253] Gimzewski in interview with the author, UCLA, March 9, 2009.

While Gimzewski denies that works like *Blue Morph* are especially conceived in a way that favors a spiritual approach to them – "it just happens that way",[254] Vesna underlines the importance of the more emotional reading of their art.

> It is very interdisciplinary in its core and I am interested in it in a way that connects to my previous work, but I also feel that it is a nice way of getting people to thinking on a different higher level. In the past I would do pieces where people would get stuck on the technology in media arts, like 'how did you do that sensor and interactivity'. And that is *not* what it's about. It is really hard to get people off this thinking about the 'hard facts' and to explore the different zones of consciousness. […] That is what art has always been. That is what art is about. I think whether you are doing classical painting or cutting edge technology research that is where you want to take the audience to a place that's ephemeral, that's inspirational, that cannot really be explained, that cannot be articulated and that's what you call spirituality.[255]

Spirituality here becomes the meeting point of art and science. Nanotechnology and research are merely a springboard for the investigation of a 'beyond'. It is the same pattern we see at work at the Ars Electronica edition "ENDO & NANO" ten years earlier. At the nanoscale, science operates in inaccessible and invisible spaces. It is the invisibility that renders those hidden worlds occult and mysterious, waiting to be explored. I shall elaborate on this aspect more in-depth later in this chapter.

Just like in *Zerowave*, the artistic exploration of the 'beyond' in *Blue Morph* is connected to perceivability and human experience. Nanoscientist Gimzewski stresses sound as a means of communication and immediateness. He and his team had already been working with sound in order to adjust their scanning tunneling microscope at IBM Zurich Research Laboratories in Switzerland in the 1980s. "[…W]e actually were using a set of headphones listening to the microscope working. Because at that time we never had the equipment to decompose it into these sonograms and it became really interesting to listen and by listening I could tell if it was working – how it was

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[254] Ibid.: Gimzewski: "[…] But you could say that when you merge those two, the art and the science, it covers many things, you know. […] Art and science, I think it just enhances this kind of higher vibration. I think that is the result. And that is based on experimental observation when we do these things, like Nanomandala, Quantum Tunnel. […] I don't try to be spiritual about it. It just so happens that the spiritual comes out of it."

SMS: "Even though, the setting you set up – you said yourself, the atmosphere with the blue light and the dark, the amplified sounds – I guess that already encourages the more spiritual side. It's not a light-flooded hall without any space of retreat…"

Gimzewski: "Yeah, but I don't purposely design it that the main goal is spiritual. I think we design it that it has got something aesthetic to it, you know. But it is not *meant* to put people into this state you see. And I find that fascinating."

[255] Vesna in interview with the author, UCLA, March 9, 2009.

working, what the problems were."[256] The immediateness of sound and the intuitive response of the scientists to it reappear in *Blue Morph*. The gallery visitor is touched by a soundscape of modified research data, the actual experience seems to represent a corporeal link to the metamorphosis of the butterfly.[257] With a rough idea about the source of the sound in the artwork, one will be under the impression of *perceiving* the transformation from one being into another on the nanoscale. The directness of sound that already fascinated the scientists during their research is used in the installation to impress the visitor, almost to cast a spell on her. The mise-en-scène of the whole work encourages this persuasion – the dim blue lighting, the vibration of the ground, and the stage for meditation.

> Nano is not only making the invisible visible but also changing our way of relating to "silence" or making the in-audible audible. With all the noise of chattering technologies and minds, we propose the interactivity to be stillness for in this empty space of nano we can get in touch with the magic of continuous change. But most of all we embrace the absurd and in a surge of laughter recognize our limited human viewpoints. The piece emerges in sound and pattern only when the viewer is
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> STILL and SILENT.[258]

Yet what exactly can be perceived? As the cells themselves do not emit any audible sound, what we can hear in the gallery space is the end product of a number of transcriptions and transformations of data. One cannot *listen* to metamorphosis. The visitor will merely have a quasi-experience of this idea, listening to cellular movements, turned into algorithms, curves which are subsequently amplified, transposed into sound which is then replayed in the gallery space. Like in their first piece *Zerowave* with its monumental projection of molecular structures, it is the amplification that ultimately creates the link between nano object and art consumer. As a bridge into invisible worlds, amplification is the essential technique which renders ostensive not only the atom to the scientist, but analogically also overarches scientific

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[256] Gimzewski in interview with the author, UCLA, March 9, 2009.

[257] Cf. e.g. on the haptic qualities of sound: Klaus Theweleit, "Jimi Hendrix. Der elektrifizierte Körper", *31. Das Magazin des Instituts für Theorie*, No. 12/13 (Dec 2008): Taktilität – Sinneserfahrung als Grenzerfahrung, 111-120, esp. p. 116-117, 119. The physicality of sound becomes *visible* for example in artist Finnbogi Pétursson's artwork *Earth* using the so-called Schumann Resonance.

[258] *Blue Morph*, official text, artsci.ucla.edu/BlueMorph/concept.html.

concept and gallery space. "Nano amplified to the human scale" staged in an art context relates back to what Bruno Latour calls "chains of translation"[259].

Interlude – Colorful images of invisible worlds

The artworks in focus here operating with conceptions of the hidden, the invisible, all relate to microscopy and techniques of image production. Goldberg's and Böhringer's *flw* is never presented in the gallery without its emblematic (optical) microscope as a constitutive part of the installation design. *Zerowave* and *Blue Morph* both were created after a long phase of exchange and debate between the media artist Victoria Vesna and the nanoscientist James Gimzewski. The pivotal role of microscopy and subsequent image production in nanotechnological research is something worthwhile illuminating. From a science studies perspective it is interesting to see what is actually underlying the *objects* of nanoart. A glimpse at the backbone of the artworks will reveal technical matters concerning their *sujet*. It will show how artistic decisions are aligned with the metaphorical surplus that the technoscience seems to offer.

In his seminal publication *Pandora's Hope. Essays on the Reality of Science Studies*, Bruno Latour contemplates analogy, transscription, and transformation in the scientific context. He approaches the book's central question – the century-old philosophical argument on the existence of 'reality' – by reflecting on the process of transforming the observed world into a representation of it. The anthropologist and sociologist of science therefore dedicates his analysis to retracing 'referentiality' in scientific operations. The act of abstraction and translation from the "world of things" into a "world of signs" (referents) is characterized by reduction. 'World' is transformed into 'discourse' when a research object is turned into data, described, or depicted in any way. "[W]ith circulating reference, phenomena are what routinely circulates through the cascade of transformations."[260] What he calls 'circulating reference' is something we also find in scientific images: "Through successive stages they link us to an aligned, transformed, constructed world." [261] When the world is reduced to representations of it, a number of qualities are lost in reduction; but there is also the

[259] Bruno Latour, *Pandora's Hope. Essays on the Reality of Science Studies* (Cambridge MA and London: Harvard University Press 1999), esp. p. 69-74.

[260] Ibid., p. 72.

[261] Ibid., p. 79.

benefit which allows us to refer to a detail of the world now by pointing at an illustration.[262]

The same is true for nanotechnology and its representations of the world. Experiment, microscopy, and (scientific) images play a major role in the media-related illustration of the nanometric scale. Being heavily reliant on sophisticated equipment, the term nano*technology* implies the inextricable link to technological tools, most of all the invention of the scanning tunneling microscope (STM) and later the atomic force microscope (AFM) in the 1980s. The term 'nanoscience' is therefore utilized much less frequently than 'nanotechnology'. [263] Nanotechnology (or "nano-technoscience", as some scholars put it)[264] has become a figurehead of the age of technoscience.

On a merely descriptive level, 'technoscience' designates the inseparable entanglement of the scientific and the technological in the process of knowledge production nowadays. It was created as a label by science scholars in the course of the last quarter of the 20th century in order to describe the now commonly "intertwined production of abstract knowledge and material devices"[265]. Molecular biology, the so-called 'life sciences' in general, and nanotechnology represent emerging research areas that are essentially dependent on high-tech tools for experiments and consequently for their consolidation of scientific 'facts'. Philosopher Gilbert Hottois calls this "la nature technicienne-opératoire de la science contemporaine".[266] Reflecting on the social and epistemological implications of the technosciences, Bruno Latour and Donna Haraway have introduced different concepts of how ontological orders have to be overhauled, how the natural and the artificial converge more and more in the (scientific) construction of 'reality', how 'nature' and 'culture' have become increasingly intertwined.[267]

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[262] Ibid.

[263] In general, I use them synonymously unless specified otherwise by the context.

[264] E.g. N. Katherine Hayles, "Connecting the Quantum Dots: Nanotechscience and Culture", in: N. Katherine Hayles, ed. *nanoculture. Implications of the New Technoscience* (Bristol und Portland OR 2004) , 11-23, p. 14.

[265] Daniel Patrick Thurs, *Science Talk. Changing Notions of Science in American Popular Culture* (New Brunswick et al. 2007), p. 180.

[266] Gilbert Hottois, *Entre Symboles et Technosciences : Un Itinéraire Philosophique* (Seyssel : Ed. Champ Vallon 1996), p.10.

[267] For a comprehensive discussion of Latour's and Harraway's philosophies on technoscience cf. Jutta Weber, *Umkämpfte Bedeutungen. Naturkonzepte im Zeitalter der Technoscience* (Frankfurt Main: Campus 2003), esp. p. 91-97; Reichle 2009, p. 6-11.

Putting aside a deeper philosophical discussion of technoscience's epistemological consequences,[268] it is worthwhile to take a look at the question of simulation and referentiality in nanotechnology. The digitalization of the 'world' – for example cellular surfaces – into images is a prerequisite of nanoscientific research and for the construction of 'knowledge' at this scale. Jochen Hennig has excellently analyzed the importance of image production in nanoscience. He retraces Gerd Binnig and Heinrich Rohrer's construction of nanoscale images in the early 1980s: how the two IBM researchers (who later won the Nobel Prize in physics for the invention of the STM in 1981) turned digitalized graphs measuring tunneling currents at the atomic level first into composite figures, then into a paper model of the silicon surface 'relief', until finally obtaining – or rather: creating – color-coded topographic representations.[269] Following Latour, we witness a loss of resemblance (*adequatio*) from one mode of representation to the next.[270] Yet there is always a given referentiality: the first graph refers to differences in currents on the atomic level, the composite image refers to this graph, and the paper model of the surface relates to the composite graphs. From the invisible structure of a silicon surface suddenly rises a multi-colored image of an atomic landscape. Measuring electrical properties with an STM, inscribing the change of currents into graphs and diagrams, reworking these diagrams into burnished grey-scale images and finally into visualizations obeying "color-codes used in cartography"[271]: all these steps illustrate how scientists use high technology in order to render visible an invisible aspect of reality. It shows how the final outcome of the visualization process is highly manipulated and strongly influenced by social preconditions, on the individual research level as well as on the science-historical level due to the establishment of image conventions.[272] By the late 1980s, a "decisive

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[268] For a substantiated analysis of the subject cf. Weber 2003.

[269] Jochen Hennig, "Changes in the Design of Scanning Tunneling Microscopic Images from 1980 to 1990", in: Joachim Schummer, Davis Baird, eds., *Nanotechnology Challenges. Implications for Philosophy, Ethics and Society* (Singapur u. a. 2006), 143-163, p. 144-150. See even earlier: Joachim Krug, "Ein Auge welches sieht, das andre welches fühlt. Bilder aus der physikalischen Nanowelt", in: Bettina Heintz, Jörg Huber, eds., *Mit dem Auge denken. Strategien der Sichtbarmachung in wissenschaftlichen und virtuellen Welten* (Vienna and New York 2001), 121-139, esp. p. 130-139.

[270] Latour 1999, p. 73, 78-79.

[271] Hennig 2006 a, p. 151.

[272] For further discussion of the construction of images of 'reality' and research images cf. for the context of nanotechnology: Jochen Hennig, "Instrumentelle Bedingungen in Bildern der Rastertunnelmikroskopie", in: Helmar Schramm, et al., ed. *Instrumente in Kunst und Wissenschaft. Zur Architektonik kultureller Grenzen im 17. Jahrhundert* (Berlin 2006), 377-391; on the science historical context: Stefan Ditzen, "Der Satyr auf dem Larvenrücken. Zum Verhältnis von instrumentellem Sehen

change" has come about: "No longer is the path of the tip [of the STM] transformed into an image. The individual constituent parts of the measurements have been put together in a manner that suggests an apparent reproduction of the investigated object." From now on, scientists visualize "according to the expectation that an atom has the shape of a hill or a sphere and not a valley".[273] Hennig emphasizes that implicitly images were soon no longer a result of an experiment with the STM but visualized atoms. They became signs designed by convention, icons based on symbolic representations and conform to expectations of the common public.[274] "[The] images became compatible with nanotechnological visions."[275]

Nanotechnology initially arises in order to render visible something hidden to human perception. The development of ever more efficient microscopes leads to the invention of the STM and later the AFM, technological devices that still carry the name of their predecessors (from the Greek *μικρός* – 'small', plus *σκοπεῖν* – 'to look at'). But these new microscopes no longer allow us to 'see' the very small through optical magnification. Rather, they scan the probe's surface with a very fine tip (on a so-called cantilever) which allows the recording of electric properties between tip and atomic surface. This operation is commonly described by the metaphor of 'feeling the surface'. And not surprisingly, it is this insinuation of *touch* which becomes characteristic of many nano artworks.

"Nesta obra, a escala nano foi ampliada para a escala humana."[276] The importance of 'amplification' cannot be overestimated in the scientific process and the nano artworks all orbit around the selfsame issue. In *Zerowave*, Victoria Vesna and James Gimzewski

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und Bildtraditionen", in: Martina Heßler, ed. *Konstruierte Sichtbarkeiten. Wissenschafts- und Technikbilder seit der Frühen Neuzeit* (Munich 2006), 41-56; on the digital image in science in general cf.: Dieter Mersch, "Naturwissenschaftliches Wissen und bildliche Logik", in: Heßler 2006, 405-420; or Martina Heßler, "Die Konstruktion visueller Selbstverständlichkeiten. Überlegungen zu einer Visual History der Wissenschaft und Technik", in: Gerhard Paul, ed. *Visual History. Ein Studienbuch* (Göttingen 2006), 76-95.

[273] Hennig 2006 a, p. 156.

[274] Ibid, p. 157-160.

[275] Ibid., p. 145. Here however, one has to carefully differentiate between 'sober' research images and manipulated research images serving for example as covers for books and magazines. Cf. for further general reading Hans-Jörg Rheinberger's preference of the term 'visualization' rather than 'representation' due to the problematic question referentiality: Hans-Jörg Rheinberger, "Objekt und Repräsentation", in: Heintz/Huber 2001, 55-61; also on the problematic constitution of a scientific ‚representation' Hans-Jörg Rheinberger, *Experimentalsysteme und epistemische Dinge. Eine Geschichte der Proteinsynthese im Reagenzglas* (Göttingen 2001), esp. p. 109-118.

[276] Website of the Museu de Arte Brasileira on *Zerowave*, www.faap.br/hotsites/hotsite_nano/interna.html.

address human perceivability in summoning the invisible to a huge projection screen. Buckyballs are supposed to bring remote worlds into the gallery space for the visitor to play with. Dim projections of magnified lamellate patterns of a butterfly wing complete *Blue Morph*'s accoustic overall experience. Yet art's general capacity to use, appropriate, re-produce, and generate images is outrun by artistic proposals beyond the image. The media artworks all involve the bodily experience of the spectator. The sense of touch becomes equally important, even more important than the visual in these works. A person's shadow serves as interface between its physical proprietor and a simulated buckyball, a soundscape encloses *Blue Morph*'s visitor sitting on a vibrating sensor mat – yet not only in Vesna's and Gimzewski's oeuvre the tactile assumes a central position.

Touching the Nano World: Nano-Scape

Around the same time that Vesna and Gimzewski start their cooperation at UCLA, the media artists Christa Sommerer and Laurent Mignonneau present their artwork *Nano-Scape*, which they develop for the exhibition "Science + Fiction" at the Sprengel-museum in Hanover, Germany in 2002.[277]

> The goal of the "Science + Fiction" exhibition was to bring together artists and scientists to reflect on some of the burning social issues such as "Identity in Global Culture", "Brain Research" and "Nanotechnologies" and to analyze their perception in the sciences and in popular culture. Our task as media artists was to bring the theme of "Nanotechnologies" closer to the public awareness. We decided to do this by producing an intuitive experience where users can interact with invisible self-organizing atoms using a magnetic force feedback interface.[278]

The 'intuitive experience' that the two artists create is an interactive installation consisting of a table-like surface which is divided into four parts. The user will take one of the provided magnetic rings and will move it slowly across the table's surface. In doing so, he or she perceives varying magnetic repulsion – something the artists call a 'magnetic sculpture'. If more users participate (the installation is conceived for up to

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[277] Since then, *Nano-Scape* was to be seen among others at the Nobel Museum, Stockholm in 2004, in Tokyo's Science Museum Miraikan in 2005, at the exhibition "Territoires Invisibles" at the Maison Européenne de la Photographie, Paris in 2007 and at "Art in the age of nanotechnology" at John Curtin Gallery, Curtin University of Technology in Perth in 2010.

[278] Christa Sommerer and Laurent Mignonneau, "Nano-Scape. Experiencing Aspects of Nanotechnology through a Magnetic Force-Feedback Interface", *ACM SIGCHI International Conference on Advances in Computer Entertainment Technology*,15th -17th June 2005 Polytechnic University of Valencia, Spain, 200-203, p. 200.

four users), they will be able to feel constant changes in the magnetic field underneath their respective ring. The enclosed scene is bathed in blue light. Outside of the installation box, a monitor shows the simulation of an atomic structure. According to the users' interaction with the installation and with each other, it depicts the constantly changing balance of force in the 'atomic' network. The monitor is located in such a way that it cannot be seen by the user from within the installation box.

The idea behind *Nano-Scape* is to "let visitors intuitively experience aspects of nanotechnology by interacting with invisible self-organizing atoms through a magnetic force feedback interface".[279] Like in Vesna's *Zerowave* where the manipulation of molecules is reduced to mere *simulation*, in Sommerer's and Mignonneau's artwork the claim to interact with atoms, to be able to 'feel' them, is obviously just a metaphor. The entanglement of scientific information and presumable 'intuitive experience' deserves an analysis.

At a swift glance, there is nothing more to *Nano-Scape* than the experience of magnetic repulsion. Unless the visitor is willing to sacrifice some time and inform herself about the idea of the work, its conceptual complexity stays hidden behind the scene. Nevertheless, *Nano-Scape* is informed by a number of scientific details according to which the installation was conceived.[280] The two artists approached the theme of nanotechnology from its core, that is from the idea of molecular and atomic manipulation. Self-organization of atomic structures as studied by nanoscience was another motif to be integrated into the interactive art piece. A haptic interface for several users was supposed to bind the two scientific concepts together, yield 'intuitive experience' of the nanoworld and "show how intricate and complex interactions on a nano-scale level can be".[281] A force-feedback interface was thus created by setting four magnetic coils into each of the four table compartments producing a field of up to 6000 gauss;[282] the user's magnetic ring with a strength of around 2000 gauss would thus serve as the interface with the installation. Classical video tracking captures the user's hand movements with an infrared camera installed above the table's surface.[283] The position of the individual magnetic ring is then processed by a software which

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[279] Ibid.

[280] Cf. ibid. and www.interface.ufg.ac.at/christa-laurent/WORKS/CONCEPTS/NanoScapeConcept.html.

[281] Sommerer & Mignonneau 2005, p. 201.

[282] That is up to 120 times stronger than a typical refrigerator magnet.

[283] Sommerer & Mignonneau 2005, p. 201.

constantly re-calculates changes in the simulated atomic structure and adapts the force of the coils' magnetic field accordingly. The user is thus simulated as one atomic 'player' in the structure of atomic forces. When entering interaction with the installation, initially simulating an (invisible) state of maximum cohesion between 120 atoms, the user begins to perturb this cohesion with his magnetic ring and the atoms' position will be re-calculated in order to reach an equilibrium state again.

The artists modeled the system of atoms on noble element crystalline structures in which each atom has 12 equidistant neighbors. "The main concern of the atoms in forming such solids is to have as many neighbors as possible, in order to maximize the cohesion since all interactions are attractive."[284] It is interesting to note how the artists adopt the common scientific parlance of ascribing agency to the atoms: the particles have "concerns" and they have "neighbors" to interact with. *Nano-Scape*'s idea is that up to four users can interact with these atoms and with each other. In multiple user interaction the atomic structure is simulated according to four sources of interference. Each user will be able to feel the simulated forces exerted by its neighboring atoms through the correspondingly changing electromagnetic field underneath his or her magnetic ring. Strong movements and disturbances of the simulated equilibrium will cause strong electromagnetic forces "sometimes to the point where the magnetic ring will start to vibrate".[285]

The haptic experience of the gallery visitor is not complemented by the concretized visualization of the atomic structure, for the monitor displaying the interaction is set up outside of the installation space. "This was a conscious decision, firstly because the nanoworld is usually not visible and secondly, because as displaying visual information would have distracted the users from feeling the atomic forces."[286]

Sommerer and Mignonneau target the tactile sense for their central theme. With their 'magnetic sculpture' they allude to the theme of topographic surfaces that are the emblem of nanotechnology. Atomic landscapes with hills and valleys have not only become a visual convention in nanotechnological imaging nowadays,[287] they also coin our understanding of this invisible terrain – an understanding which is based on macro-scale experience. In a way, the artistic duo ingeniously combines topographical

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[284] Ibid., p. 202.

[285] Ibid., p. 203.

[286] Ibid.

[287] See above, Hennig 2006 a.

structures (that is the idea of a 'sculpture') with forces on the atomic level by simulating so-called van der Waals forces with a force feedback interface. The functioning of nanotechnological devices like the AFM relies on exactly these forces in order to produce images of the nanolevel and manipulate atomic probes. However, as the artists admit themselves, the artwork is ultimately not at all about the illustration of scientific data or facts, but about an 'intuitive perception' of the nanoworld. This 'perception' is mediated by simulation, amplification, and transformation. The "virtual touch"[288] Sommerer speaks about which can be experienced when more than one user interacts with the system has nothing to do with the 'nanoworld'. The artists want to address the invisible by excluding relevant visual data from the installation space omitting the fact that the nanoworld is *per se* also not tangible.[289]

The metaphor of 'feeling the atomic surface' is often employed in the nano-technological context and relates back to the functioning of tunneling microscopes. It also informs *Nano-Scape*. Yet just like in Vesna's and Gimzewski's molecular manipulation in *Zerowave*, the actual experience of the nanoworld is based on quasi-analogies and vague connections. Invisible as it is, nano is also *not* accessible through human touch. Merely via simulation, simplification, and translation into a different medium, the atoms and molecules become metaphorically 'accessible'. It is then not the nanoparticles we access, it is the *conception* of them. The experience is *quasi*. Only the interested visitor will learn more about the conceptual apparatus behind the installation by reading the textual material on the artwork. What *Nano-Scape* does is first simplifying, then amplifying nanotechnological concepts. One may concede to the artwork that they participate in the process of turning 'world' via reduction into 'discourse'. The gradual amplification that constitutes this process is part of the work.[290]

Also in the nanotechnological research context, tactility has been accorded a high status. In the early 1990s, scientists of the Department of Computer Science and

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[288] Ibid.

[289] This aspect is inextricably linked to nanotechnological image production which "give[s] the feeling that one could simply reach out and touch the atoms", David S. Goodsell, "Fact and Fantasy in Nanotech Imagery", *Leonardo* (2009), Vol. 42, No. 1, 52-57, p. 53.

[290] Cf. Latour 1999, p. 71-72. "The transformation at each step of the reference […] may be pictured as a trade-off between what is gained (amplification) and what is lost (reduction) at each information-producing step.", p. 71.

Physics at the University of North Carolina at Chapel Hill developed the so-called *nanoManipulator*. The device consists of an interface including a software allowing the scientists to move the tip of an AFM through a haptic feedback system. Manipulations on the nanoscale surface of a probe are thereby rendered perceivable by the human tactile sense. With the *nanoManipulator*, not only the visual sense is activated via integrated 3D computer graphics, but also the sense of touch via a pen-shaped instrument which the user takes in hand. Also here, perceivability is achieved first through conceptualization of the invisible world and secondly through subsequent steps of amplification. Since 1992, the system is ongoingly improved and used in research.[291]

James Gimzewski's remark about the importance of acuesthesia in their IBM research during the 1980s here comes to mind. "Listening to the microscope working" and adapting research movements accordingly is another way of activating a sense apart from the visual. The immediacy of both senses, the tactile and the auditory, is linked to their specific embodiment and is also central in research.[292]

In its goal to render 'nano' intuitively perceivable, *Nano-Scape* above all instrumentalizes magnetic repulsion in a specifically designed artistic setting. "The interface [i.e. in this case the magnetic ring] serves as a navigational device and as the translator between two parties, making each of them perceptible to the other."[293] A magnetic interface plus software links the pivotal question of self-organization and complex systems to the user of the artwork. It creates an environment in which the visual becomes peripheral. While Sommerer and Mignonneau have experimentalized with a similar set-up in their previous work *A-Volve* (1994), the high significance of the tactile sense and a deprivation of the visual is new in *Nano-Scape*. In *A-Volve*, visitors use a touch screen in order to 'draw' virtual creatures that then move about a water basin and can be pushed or stopped – interacted with – by the visitor's hand movement. The creatures obey simplified and simulated evolutionary rules. *A-Volve* is

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[291] Cf. cismm.cs.unc.edu/core-projects/ideal-microscope-interfaces/nanomanipulator/ and cismm.cs.unc.edu/core-projects/force-microscopy/nanomanipulator/.

[292] Cf. Renaud Barbaras on touch and hearing: "in touch, occuring through physical contact, the thing is experienced 'at the tips of the fingers' rather than outside of the one sensing [as would be the case with seeing], and I hear the sound 'in the ear' rather than situating it in space.", cited after Mark B. N. Hansen, *Bodies in code. Interfaces with digital media* (New York and London 2006), p.73.

[293] Paul 2003, p. 70.

an exploration of human interaction with the virtual beast, in which the visual is given privilege over the sense of touch.[294]

The whole installation immersed in blue light and the table whose surface is to be scanned with the hand works with effects similar to the former artwork, but *Nano-Scape* favors the invisible, thus a different mode of experience. Staging the inaccessible, invisible spaces, and atomic forces pretendedly felt by the human hand, *Nano-Scape*'s blue-lit set up and particularly the official installation views disseminated by Sommerer and Mignonneau are reminiscent of an older image tradition – that of spiritualism.[295] Also here, nanoscientific details are not dryly presented within the framework of a science exhibition. They are not 'presented' at all; they are rather subject to a mise-en-scène in a dimly lit room.[296] A group of people gathers around a gleaming table, extends their hands over its surface in order to witness hidden forces and feel the 'virtual touch' of the invisible. To experience this *influence sur le corps* was and is something advocated by the spiritualist movement eager to give proof of an invisible, auratic presence. The experience is direct and mysterious.

Research on various modes of the invisible predominated science in the 19th century. The scientific community now strongly focussed on phenomena of the non-visible, with Michael Faraday and his discovery of electromagnetism, the experiments in ferromagnetism by Louis Georges Guoy and Pierre Curie, Henri Poincaré's work on *n*-dimensionality, and Heinrich Hertz' experimental proof of the existence of electro-magnetic waves as well as the photoelectric effect.[297] Poincaré and others had formulated their theories on ether in response to 'empty space'.[298] Around the same time, spiritualism became highly *en vogue*, including séances and table-turning at private dinner parties. It may not be by coincidence that we also encounter

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[294] In 1997, Karl Sims experimented with a similar idea of computer-generated organisms. In his work *Galápagos*, the visitor had to step onto a sensor in order to select a virtual creature which would subsequently undergo a simulated 'evolution'. On a less conceptual level operates the work *Touch the Invisibles* by NTT-researcher Junji Watanabe and cooperators, which has been mentioned in the first chapter. Here, "virtual lilliputians" can be 'felt' through a fingernail-mounted interface.

[295] I owe this insightful association to Dominic-Alain Boariu.

[296] See installation view at John Curtin Gallery, Perth.

[297] Cf. for example Karin Krauthausen on the debates around non-Euclidian geometry and their implication for the imagination of space: Karin Krauthausen, "'My Psychology' – Überlegungen zu Paul Valérys Exploration der Imagination", in: Nina Zschocke, Anne von der Heiden, eds., *Autorität des Wissens. Kunst- und Wissenschaftsgeschichte im Dialog* (Berlin and Zurich: diaphanes) (*forthcoming)*.

[298] Cf. e.g. Donald R Benson, "Facts and Fictions in Scientific Discourse. The Case of Ether", *The Georgia Review*, No. 38, Winter 1984, 825-827.

reminiscences of spiritualism – semi-darkness, closed eyes, extended hands over a table – in *Nano-Scape*. The intuitive experience of 'atomic forces' that Sommerer and Mignonneau aim for presents itself to the visitor in form of electromagnetic repulsion. A vibrating magnet ring allows for an invisible touch and immediacy of perception. "The atomic sphere cannot be seen, but felt. A sensuality beyond the visual emerges which at the same time has a paranormal quality."[299] What Uwe Justus Wenzel describes as 'paranormal quality of impression' (orig. "übersinnliche Anmutungs-qualität") in Sommerer's and Mignonneau's work relates to the aura of science as well as to the quotation under which the exhibition "Science + Fiction" presented *Nano-Scape* among other artworks:

> Scientific theories have a peculiar content of *zeitgeist* [Weltstimmungsgehalt] which they do not formulate and which they maybe cannot even perceive… Maybe there should be some kind of a parallel poetry for sophisticated theoretical achievements which says everything once again in a different way and thereby sends back the scientific language into the boundaries of its functional system.[300]

Niklas Luhmann's idea of a poetry running parallel to the scientific language offers a colorful circumscription of what a lot of the artworks are about. In this case, nanotechnology was not presented as such. Rather, the artwork plays with analogies and vague translations of the nanoworld, out of which surfaces the sensual experience of something understood as curious, mystical, even 'paranormal'. It is the *meaning* of this deflection of Latouresque referentiality from a nanotechnological research probe to a gallery visitor's personal tactile experience that I am interested in exploring further. I understand the artwork here as an *object* revealing a metaphorical superstructure which is examplary for much of 'sci-art'. Before coming back to this, however, it will be expedient to have another look at the *actors* and some monetary factors in the field of 'art and science' in order to better understand sci-art's very worldly freedom and constraints.

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[299] Uwe Justus Wenzel, "Weltstimmungsgehalte. «Science + fiction» - eine Ausstellung in Hannover", *Neue Zürcher Zeitung*, 25. Jan 2003, online source: www.nzz.ch/2003/01/25/fe/article8MVA9.html.

[300] Niklas Luhmann cited after Stefan Iglhaut, Thomas Spring, eds., *Science + Fiction. Zwischen Nanowelt und globaler Kultur*, Vol. Images and Texts (Berlin 2003), p. 15. The quote is originally taken from Luhmann's *Soziologische Aufklärung. Vol. 3: Soziales System, Gesellschaft, Organisation* (Wiesbaden 2005), p. 200. In the context of the citation, Luhmann most notably reflects on *sociological* theories and the theoretical language conveying them, i. e. about reader/listener and the communication of science.

Nano players, places, networks

In the early 2000s, 'nano' assembled various artists and collaborative teams under its name promising the nimbus of novelty, progress, and next generation technology. Apart from Christa Sommerer and Laurent Mignonneau, Victoria Vesna and James Gimzewski, there were other players entering the arena with media artworks veiling or reveiling the nanoworld. The *UCLA Art | Sci Center* was a breeding ground for further projects. Vesna and Gimzewski joined their efforts in the creation of more nanoart, like *Quantum Tunnel* (2003) or *Nanomandala* (2003). The latter is an installation merging science and spirituality in an even more obvious way: In form of a video, a sand mandala created by Tibetan monks was projected onto a round basin filled with sand, visitors could "touch the sand as images are projected in evolving scale from the molecular structure of a single grain of sand – achieved by means of a scanning electron microscope (SEM) – to the recognizable image of the complete mandala, and then back again."[301] Eastern thought met nanotechnology and the very small once again was beclouded by spirituality.[302] Also within the creative orbit of the *UCLA Art | Sci Center*, Anne Niemetz and Andrew Pelling, graduate students in art and nanoscience, respectively, developed *The Dark Side of the Cell* in 2004. Prior to *Blue Morph*, this installation uses "cellular sounds" which Pelling had been working on in Gimzewski's research team. In the darkened installation space, the visitor encounters sculptural objects onto which "microscopic imagery of the sonic cells and their cellular sonograms are projected".[303] The whole room is immersed in a soundscape compiled by Anne Niemetz which consists of five 'movements', representing five different steps in obtaining sonic data in the research process.[304] We encounter familiar tropes in the description of the work.[305] *The Dark Side of the Cell* is linked to the "feeling" AFM with which sounds are gathered, we are now "able to listen to the sound of living cells". Finally, "[m]uch mystery is brought forth by the discovery of cellular sound,

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[301] nano.arts.ucla.edu/mandala/mandala.php.

[302] "Of the installation the artist says: Inspired by watching the nanoscientist at work, purposefully arranging atoms just as the monk laboriously creates sand images grain by grain, this work brings together the Eastern and Western minds through their shared process centered on patience. Both cultures use these bottom-up building practices to create a complex picture of the world from extremely different perspectives.", ibid.

[303] www.darksideofcell.info/about.html.

[304] "The resulting songs must be appreciated as the undiluted result of the cells, unmodified by sound effects.", ibid.

[305] *Dark Side* being the earlier work, it is *Blue Morph*'s context which reproduces phrasing and topoi that are obviously predominant in the general discourse around 'cellular sound'.

and few answers can be given."[306] Again, the exhibition room is darkened, enwraped by an electrifying soundscape allowing in the mysterious.

Just 350 miles north of *UCLA*, San Francisco's science museum Exploratorium exhibited Vesna's and Gimzewski's *Zerowave* together with *200 Nanowebbers* by Semiconductor, a British artistic duo formed by Ruth Jarman and Joseph Gerhardt. The video work of the duo created for a soundtrack by Double Adaptor in 2005 shows a hand-drawn 'molecular web' sucking the viewer into microscopic perspectives and allegedly hidden worlds. "In the Land of the Lilliputian. Artists Visualize the Very Small" was the telling title of the exhibition coupling the two dissimilar artistic approaches of 'nano' at Exploratorium's Seeing Gallery. *200 Nanowebbers* differs from the other works discussed here as it is not an interactive artwork. With an electrifying soundtrack very different from the sombre bass beats and noise-scapes in the previous works, also visually it operates with rapid movements addressing a much less mystical mode of perception.

In 2007, "Territoires Invisibles" at the Maison Européenne de la Photographie in Paris regrouped Goldberg's and Böhringer's *flw* together with Vesna's and Gimzewski's *Nanomandala*, Sommerer's and Mignonneau's *Nano-Scape*, and *200 Nanowebbers*. And three years later, nanoart congregated in Australia. The John Curtin Gallery at Curtin University of Technology in Perth presented "Art in the age of nanotechnology": *Nano-Scape* and *Nanomandala*, this time joined by artworks by Boo Chapple and Mike Phillips, and by Paul Thomas' and Kevin Raxworthy's *Nano_essence*. The Australian artist Paul Thomas had presented his previous artwork *Midas Project* for the first time in 2007, an artwork using nanotechnological research methods and an AFM gathering data around the pivotal idea behind the piece: the touch of gold.[307]

Midas Project is a visual and sonic interactive installation. With the help of scientists, Thomas cross-linked skin cells with gold, simulating the mythical finger touching gold. The gold-coated skin cells were scanned with an AFM, obtaining data of atomic vibration by the cantilever moving across the skin cells' surface. The data was then translated into visual and audio files. Data transposed into a range compatible

[306] www.darksideofcell.info/about.html.

[307] Cf. Paul Thomas, "Midas: A Nanotechnological Exploration of Touch", *Leonardo*, Vol. 42, No. 3, Jun 2009, 186-192.

with audio waves constitutes the "audible topographic map"[308] which engulfs the visitor in the – again darkened – installation space. When the visitor touches the magnified gold replica of a skin cell in the middle of the room, a thereby closed electric circuit triggeres the sonic track "to make the data from the atomic vibrations audible and palpable".[309] The projection depicts the simulation of a single skin cell based on images produced by an AFM. Each time the visitor makes contact with the golden cell replica, a software developed by Kevin Raxworthy generates virtual 'nanobots'[310]. Similar to Sommerer's and Mignonneau's idea in *A-Volve*, these phantasies of future nanotechnology obey simple evolutionary rules and 'eat' the colors in the AFM image.[311]

With his *Midas Project*, Paul Thomas links a tedious and time-consuming acquisition of scientific data to the metaphorical and science fictional of nanotechnology. Again, the 'touch' of the AFM is invoked, "reintroducing a sensorial understanding of the world"[312]. Again, the dim mise-en-scène favors enchantment rather than an outlook onto the world as a space disenchanted by science. Again, it is a sonorous soundscape immersing the installation in a specific ambiance. In his paper on *Midas* published in the renowned Leonardo magazine, the artist describes the work's sophisticated data acquisition in great detail. At the same time, he elaborates on the myth of Midas, on K. Eric Drexler's visions of nanotechnology, cites Henri Bergson, and muses on how "humanistic boundaries" of our body "are being questioned through nanotechnologies".

> The sensorial analogy of touch to nanotechnology allows us to confront life and identity in a humanizing fashion. The Midas project offers an immersive technique that fulfills our desire to be spatially connected to the world around us. Nano art in general allows for a reconfiguring of our conscious understanding of space, which is our lived experience, generating the potential for new spatial understanding.[313]

Again, it is the tactile sense along with auditory stimulation that is supposed to render the nanoworld palpable – through amplification, the reprocessing of data and trans-

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[308] Ibid., p. 190.

[309] Ibid.

[310] Nanobot, from 'nano' + 'robot': the still fictitious idea of tiny machines operating at the nanoscale, potentially utilizable in future 'nanomedicine' and other areas.

[311] Ibid.

[312] Ibid., p. 189.

[313] Ibid., 192.

lation into modes of perception other than the visual. The artwork enters the realm of science fiction with a software simulating nanobots, dreams of future nano-technological achievements. It slowly decomposes the colorful projection of an AFM image into mere shades of gold, digitally manipulating alleged authentic research material. The conception of nanobots coupled with a colorful nanoworld outrightly introduces vision and phantasy into this art project initially using nanotechnological tools.

The 2010 exhibition "Art in the age of nanotechnology" staged *Nano_essence*, an artwork co-produced by Thomas and Raxworthy in 2009. *Nano_essence* picked up core ideas of the *Midas Project* and was conceived as an audio-visual installation on the data basis of an AFM analysis of a skin cell. This time, the visitor's breath activates the visual and sonic content of the work. The exhibition text conveys the piece's spiritual framework:

> In the context of the project, breath has a strong conceptual and metaphorical link to a Biblical inception of life. […] The humanistic discourse concerning life is now being challenged by nanotechnological research that brings into question the concepts of what constitutes living. The space of the body can be seen at an atomic level as having no defining boundaries. The proposal for nanotechnology to reshape nature atom by atom develops an interesting debate as to the constitution of life. The Nano_essence project aims to construct a physical experience to examine a spatial envelope between the scientific and metaphysical world.[314]

Although the artists claim to present highly authentic research data in form of images and sound in order "to engage the viewer in a sensorial qualitative experience of quantitative data"[315], the artwork is obviously aimed toward a reflection on the 'metaphysical'. The visitor does not encounter quantitative data on display in the exhibition space, but a breath interface connected to an abstract visual projection as well as an electronic soundscape.

Hanover, Germany, in 2002 – Los Angeles, United States, in 2003 – Tokyo, Japan, in 2005 – Perth, Australia, in 2010: nanoart is an international first world phenomenon like most variations of media art. Players in the field meet and intersect at recurring places. The interest in nano still seems unbroken. Networks are tightly knit in the art-

[314] On: johncurtingallery.curtin.edu.au/exhibitions/archive/2010.cfm.
[315] Ibid.

science field. It might be a niche in contemporary art, but it is a big one. Where art and science meet, technology lurks just around the corner. Machiko Kusahara, one of the main promoters of Japan's Device Art, is not only professor at Waseda University, Tokyo, but also visiting professor at the *UCLA Art | Sci Center*. Together with its artistic director Victoria Vesna, Kusahara was a member of the thesis committee of media artist Anne Niemetz' MFA thesis on "singing cells" and art. Vesna obtained her PhD at the University of Wales within the same PhD program (at CaiiA) as did Jill Scott, the director of the Zurich Artists-in-Labs program. Together with the renowned media theorist Roy Ascott and James Gimzewski, Vesna and Scott are active members of the research platform Planetary Collegium (formerly CaiiA-STAR[316]) at the University of Plymouth with its *M-node* in Milan and its *Z-node* in Zurich, of which Scott officiates as vice director. Christa Sommerer and Laurent Mignonneau both are professors at the InterfaceCulture Lab of the University of Art and Design in Linz, Austria, the city hosting the annual Ars Electronica Festival. Sommerer obtained her PhD with Roy Ascott at (then still) CAiiA-STAR in the United Kingdom; Mignonneau at Kobe University in Japan in 2001, where Kusahara again was associate professor since 1998. Before moving to Linz, Sommerer and Mignonneau held posts as associate professors at Japan's important media art center IAMAS in Gifu from 2001 to 2004. Unlike the Device Art scene, which links media art and technological development in Japan in a national framework of economy-driven sponsorship, it is striking how in nanoart art and science merge almost exclusively in the academic environment.

2. Who pays? Big Science and Big Business

Although science and technology are often mentioned in the same breath, the composites 'art and technology' and 'art and science' are significantly misaligned. The reason is obvious and is based on the question of commercialization and industrializability. In Japan, with its important corporate funding but significantly less public funding for contemporary art, a considerable 'art and science' scene is strinkingly absent.[317] Michael Naimark distinguishes between 'market money' and

[316] CaiiA-STAR was one of the first PhD programs ever to be conceived for artists, cf. Reichle 2009, p. 193.

[317] Exceptions to the rule are Takuro Osaka, art professor at Tsukuba University, with his collaboration with the National Space Development Agency of Japan (NASDA) and his *Cosmic Ray Series*; Kumiko

'non market money' in his analysis of funding for the media arts.[318] His survey of funding bodies worldwide clearly illustrates how the Japanese case of tightly entangled industry-funding and technological research differs from US-American and especially from European support by academia, or government (for example through science museums).

Nanoart is embedded in an art field whose specificity is similar to that of the conceptual or process-based artwork as an art form liberated (at least partially or allegedly) from market forces. Art that is no longer marketable in a traditional way seeks a theoretical niche allowing more freedom and securing funding from sources other than the conventional art market. 'Art as knowledge', 'artistic knowledge', and other similar terms have become ubiquitous in the past few years. They designate sometimes quite divergent activities and ideas in the field of contemporary art. The rhetorical trope of art as knowledge or knowledge-generating is in vogue all the more in media art and its academic environments. Where art and science merge, the question of 'knowledge' in artistic pratices surfaces almost immediately.[319]

Especially the 1990s and the consolidation of Visual Studies bring along a growing number of contributions to the discursive field of 'artistic knowledge'. An examination of this parallel development would deserve a proper research study – a discourse analysis dedicated to the genesis and meaning of the term 'knowledge' and its derivatives in the contributions to Visual Studies and current art theory.[320] Generally,

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Kushiyama with her thermal artworks ('Thermoesthesia'); or Hideo Iwasaki, associate professor of biology at Waseda University, with his mixed media bioart works.

[318] Naimark 2003, p. 26.

[319] Since the 1970s, there have been a number of publications eager to highlight structural analogies between the arts and the sciences, e. g. Douglas Davis, *Art and the Future. A History/Prophecy of the Collaboration between Science, Technology and Art* (New York 1973), esp. p. 178-180. Douglas Davis does not use the term 'knowledge' itself, but insinuates knowledge-like concepts in describing structural similarities between science and art in their 'search for truth'. See also Paul Feyerabend, *Wissenschaft als Kunst* (Frankfurt Main 1984); Paul C. Vitz, Arnold B. Glimcher, *Modern Art, Modern Science. The Parallel Analysis of Vision* (New York, Philadelphia 1984); or Martin Kemp, *Visualizations. The Nature Book of Art and Science* (Oxford: University Press 2000). For a very insightful overview on the various positions see Linda Dalrymple Henderson, "Editor's Introduction: I. Writing Modern Art and Science - An Overview. II. Cubism, Futurism, and Ether Physics in the Early Twentieth Century", *Science in Context* 17(2004), No. 4, 423-466, esp. p. 423-436.

[320] This analysis would have to take into account the essential difference of the concepts of art as a form of 'knowledge' and art as '*Erkenntnis*' departing from Immanuel Kant's *Critique of Judgment*. An earlier example of art as *gnosis* in the German-speaking context is Gernot Böhme's "Kunst als Erkenntnisform", in: G. Böhme, *Für eine ökologische Naturästhetik* (Frankfurt Main 1989), p. 141-165. A rather broad understanding of 'knowledge' underlies Böhme's *Kunstwissen*. Primarily however, his argumentation circulates around terms like 'experience' and 'atmosphere' rather than 'knowledge'. Also Peter Weiss describes art as a specific form of aesthetic '*Erkenntnis*': *Ästhetik des Widerstands*

Visual Studies and the proclamation of the often-cited *iconic turn* or *pictorial turn* are attributed to the then emerging digital media.[321] The development of technological phenomena is inevitably linked to the analysis of their implications, thus also to new theoretical currents in the humanities. We have been witnessing an ongoing prosperity of the rhetorical entanglement of art, science, and knowledge for more than two decades now.[322] In the heyday of a term, this not seldom leads to a loss of its meaningfulness. 'Knowledge' has unfortunately oftentimes been reduced to a buzz-word serving as an impressive label more than anything else. A standard preoccupation of theorists in this context is therefore to raise the question of what the "epistemological and ontological status of these hybrid forms" of knowledge might be often without even an attempt to answer it.[323]

Terms like 'artistic research' and 'research through art' stem from similar theoretical grounds. Tightly entangled with artistic practice and most often emerging from art academies and their theory pools, these conceptions have triggered a variety of publications lately.[324] The ideas promoted in this context clearly show that there are political implications at stake, like the transformation of art academies into art universities (with research projects and PhD programs).[325] Ultimately, 'art as research'

(Frankfurt Main 1983) – cf. Heewon Lee, *Kunst, Wissen und Befreiung. Zu Peter Weiss' Ästhetik des Widerstands* (Frankfurt Main 2001), esp. p. 41-45.

[321] Jutta Held, Norbert Schneider, *Grundzüge der Kunstwissenschaft. Gegenstandsbereiche - Institutionen - Problemfelder* (Cologne 2007), p. 487. Also Geert Lovink, "New Media, Art and Science. Explorations beyond the Official Discourse", in: Scott McQuire, Nikos Papastergiadis, ed. *Empires, Ruins + Networks* (Melbourne 2005), 86-105, p. 87.

[322] See Dieter Simon's introductory remarks in *Gegenworte. Hefte für den Disput über Wissen*, Spring 2002, No. 9, p. 3.

[323] Edward A. Shanken, "Artists in Industry and the Academy: Collaborative Research, Interdisciplinary Scholarship, and the Interpretation of Hybrid Forms", in: Jill Scott 2006, 8-14, p. 13. Cf. also Rachel Mader, "*Nameless Science* – künstlerische Forschung zwischen Institutionalisierung und kreativer Autonomie", in: Zschocke/von der Heiden *(forthcoming)*.

[324] Cf. early on Stephen Wilson, "Art as Research", 1996, online source: userwww.sfsu.edu/~swilson/papers/artist.researcher.html; also James Elkins ed., *Artists with PhDs. On the Doctoral Degree in Studio Art* (Washington DC 2009); Patricia Leavy, *Method meets art. Arts-based research practice* (New York 2009); Katy Macleod, Lin Holdridge, eds., *Thinking through art. Reflections on art as research* (London 2008); Christoph Schenker, "Künstlerische Forschung", in: *Querdurch: Kunst und Wissenschaft. Veranstaltungsreihe der Hochschule für bildende Künste Hamburg*, essays ed. by Sabeth Buchmann et al. (Hamburg 2006), 147-156; *Research Art*, exh. cat. Universität der Künste Berlin, 13-15 October 2005 (Berlin: Universität der Künste 2006); Graeme Sullivan, *Art practice as research. Inquiry in the visual arts* (Thousand Oaks CA 2005); Annette W. Balkema et al., eds., *Artistic research*, Lier en boog series, Vol. 18 (Amsterdam 2004).

[325] Cf. Mader (forthcoming): "Künstlerische Forschung […] scheint heute eher ein Anliegen institutioneller Vertreter angesichts der Anforderungen aktueller gesellschaftlicher Verhältnisse, während die Kunstschaffenden selbst selten dezidiert darauf beharren als Forscher oder ihr Arbeiten als Forschung verstanden zu wissen." Mader also nicely retraces the "legitimizing discourse" in the emerging 'art as research' field and outlines the struggle around 'power' and 'monopolies'. Also Henk

is always also about hierarchies and the reputed devaluation or revaluation of art vis-à-vis other academic 'cultures'.[326]

In times when 'information society' and 'knowledge society' are omnipresent catchphrases invoked again and again in order to characterize the present, the art scene does not lag behind. At the latest by the 1960s, the embedment of technological innovations into art had brought along an increasingly prominent rhetoric describing the flirt of art with technology no longer as mere appropriation, but also as a preoccupation with knowledge-like structures. Edward Shanken has retraced the 'Art & Technology' movement and conceptual art and illuminates their relations against the background of the emerging "information age".[327] "[T]he correspondances shared by these two artistic tendencies offer grounds for rethinking the relationship between them as constituents of larger societal transformations from the machine age of industrial society to the so-called information age of post-industrial society."[328]

In aligment with Shanken, I take on a more sociological perspective for this chapter's analysis of art's entanglement with science and specifically with nano-technology. While E.A.T. and similar movements precede the ensuing development of artists-in-labs programs, artistic PhDs, and the whole art-science scene blooming today,[329] it is worthwhile to shed light on the historical evolution as well as the immanent peculiarities of a boom phenomenon. Rather than uncritically joining the current talk about art, knowledge, and research, I am interested in analyzing the breeding ground of art's interest for nanotechnology within a wider context. Instead of defending the arts against an invisible enemy due to some long-internalized feeling of inferiority, it will be more substantial for our debate to skip the ever-same Da Vinci rhetorics already uttered ad nauseam. While theorists like Stephen Wilson, Christiane Paul, or Ingeborg Reichle time and again refer to art's critical function in this context, I want to strike a more skeptical note. Apart from being a common trope, ascribing a

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Borgdorff, "Die Debatte über Forschung in der Kunst", in: Anton Rey, Stefan Schöbi, ed. *Künstlerische Forschung. Positionen und Perspektiven* (Zurich 2009), 23-51. Critically on the development of the original 'research mission' of institutions like the ZKM and the Ars Electronica Center see Dieter Daniels, "Was war die Medienkunst? Ein Resumee und ein Ausblick", in: Claus Pias ed., *Was waren Medien?* (Zurich and Berlin: diaphanes 2011), 57-80, p. 76.

[326] As shows the 'two cultures' debate since Charles P. Snow, this debate of hierarchies is nothing new, cf. Snow 1959.

[327] Subsequent to Jack Burnham's critique of the late 1960s and early 1970s, Shanken interprets both artistic currents as critically reflecting the aesthetics of knowledge systems: Edward A. Shanken, "Art in the Information Age. Technology and Conceptual Art", *Leonardo* 35 (2002), No. 4, 433-438, esp. 437.

[328] Ibid., p. 433.

[329] See the beginning of this chapter.

critical potential to the arts is surely of utter importance in specific cases.[330] The question is, however, if we really find such a potential in most of the sci-art and in the nanoart discussed here.[331] With Alfred Nordmann calling for a critique of the technosciences through the arts, I hardly see any critical essence in the nano artworks presented.

The nanoart phenomenon naturally coincides with the emergence of nanotechnology as one of the leading technoscientific phenomena of our times. National research programs on nanotechnology have mushroomed in almost every developed country. The United States established a National Nanotechnology Initiative in 2001, president George W. Bush signed the "21st Century Nanotechnology Research and Development Act" in 2003, the New National Nanotechnology Infrastructure Network was launched as a partnership network of nanotechnological research institutions in 2004. That same year, the European Commission devoted herself to nanotechnology by adopting the communication "Towards a European Strategy for Nanotechnology". Several projects on the EU level had been begun before and more and more have been pursued ever since. Even developing countries invest in the field. The Indian government for example launched its "Nano Mission" in 2007. The rise of nanotechnologies as a worldwide matter of interest has also nurtured a more critical engagement beyond the R&D sector. Research teams from backgrounds as divergent as history, anthropology, or philosophy have been encouraged to investigate societal implications of nanotechnology.[332]

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[330] See Wilson 2002 and Wilson 2010; Witzgall 2003. Especially Reichle argues for a major critical function of the arts in the age of technoscience: "It is not technoscience that is currently demonstrating to us how precarious the category 'nature' is, but art.", Reichle 2009, p. 5. Such a statement is of course highly contestable. However, Reichle is not alone in her rather daring generalization. Asking about the knowledge which the arts can produce, Nordmann hopes for an "artistic investigation in our technoscientific age". According to Nordmann, the technosciences require a kind of art criticism and aesthetic critique. See also the elaboration at the end of this chapter. Cf. Alfred Nordmann, "Experiment Zukunft. Die Künste im Zeitalter der Technowissenschaften", in: Anton Rey, Stefan Schöbi, ed. *Künstlerische Forschung. Positionen und Perspektiven* (Zurich 2009), 8-22, p. 21. Also Paul 2003, p. 214: "Art has always employed and critically examined the technology of its time, and the art of the future will equally reflect the cultural changes induced by developments in information technology as it intersects with biotechnology, neuroscience, nanotechnology, and other disciplines." All the while, the postulation of this critical function is not new. E.g. Theodor W. Adorno, *Ästhetische Theorie* (Frankfurt Main: Suhrkamp 1973), p. 335.

[331] A refreshing if quite polemical position contrasting the usual accolade is taken by Lovink 2005.

[332] E. g. the multidisciplinary nanoScience and Technology Studies group at South Carolina University, www.nano.sc.edu/research/societalinteractionswithnanotechnology/team.aspx. Numerous scholars are involved in debating ethical problems in nanotechnology. Cf. Joachim Schummer, Davis Baird, eds., *Nanotechnology Challenges. Implications for Philosophy, Ethics and Society* (Singapur et al. 2006); Fritz Allhoff et al., ed., *Nanoethics. the ethical and social implications of nanotechnology* (Hoboken,

What some call a buzzword, others call a "scientific avant-garde subject"[333]. Soon after its appearance in virtually every cutting-edge science and technology debate after 2000, nanotechnology makes its way into the art gallery. Like many art and science projects which are often funded by institutions related to 'Big Business',[334] nanoart is not seldom co-financed by funding bodies of the 'Big Science'. The "Nano" exhibition at LACMA was not only supported by several UCLA departments, but also by Canon, Epson, IBM, and NanoScience Exchange™; "In the Land of the Lilliputian" at Exploratorium's Seeing Gallery was partially funded by the National Science Foundation; the John Curtin Gallery in Perth presented "Art in the age of nano-technology" in association with the Resource and Chemistry Precinct and the Nanotechnology Research Institute at Curtin University of Technology. The renowned VolkswagenStiftung active in sponsoring research co-funded the itinerant "Science + Fiction" exhibition.

The question of who is paying is not less important in the 'art and science' field than it is in 'art and technology'. While the example of Device Art in Japan has proven the utter dependence of media art from corporate funding, international nanoart is equally dependent on funding that comes from sources beyond the art sector. Positions of players are conditioned accordingly. The nanoart created far from the regular art market somehow has to be financed. It is evident that the institutional affiliation of artists – almost all of them tightly connected to academia – is not due to mere chance. The pursuit of artistic ends beyond marketable art brings along the quest of alternative funding as well as converging rhetorics. With the prefix 'nano' resounding throughout the land (not only in Big Business, but also in Big Science), art consecrated to 'nano' in whichever way accompanies science's rousing visions and the contemporary infatuation with 'future technologies'. A scientific boom phenomenon enables the acquisition of money for the arts, entails support from academia and the educational museum.

NJ: Wiley-Interscience 2007); Deb Bennett-Woods, *Nanotechnology. Ethics and Society* (Boca Raton, FL: CRC Press 2008).

[333] "Das wissenschaftliche Avantgarde-Thema Nanotechnik", Stefan Iglhaut in: Christa Sommerer, Laurent Mignonneau, "If we knew what it was we were doing, it would not be called research, would it? Ein Gespräch mit Stefan Iglhaut", in: Stefan Iglhaut, Thomas Spring, eds., *Science + Fiction. Zwischen Nanowelt und globaler Kultur*, exh. cat. (Berlin 2003), 60-67, p. 67.

[334] Cf. for example Ars Electronica's funding partners for the "ENDO & NANO" festival in 1992: Thyssen INTERLUX Hirsch GesmbH, Lufthansa, SILICON GRAPHICS Austria, VOEST Alpine Stahl AG; or institutions like the Wellcome Trust, emanating from the homonymous multinational pharmaceutical company, which generously funds a huge variety of art-related projects, most of all related to the biomedical field: www.wellcome.ac.uk/Funding/Public-engagement/index.htm.

'Art and science' is not a disengaged branch of (media) art whose protagonists are freely connecting to scientific matter in a neutral sphere. Some artworks are in one way or the other incorporating the use of highly elaborate research devices, be it bioart involved in the growth of artificial tissue and research on genetic manipulation,[335] be it nanoartists like Paul Thomas with his *Midas Project*. Ken Goldberg and James Gimzewski are science and engineering professors whose (collaborate) artworks are a direct byproduct of their research interests. Sommerer and Mignonneau created *Nano-Scape* specifically for the exhibition "Science + Fiction" aiming at presenting art *and* science, not only sci-art. Art and science's dependence on the educational sector for its subsistence not only exerts a significant influence on the professional affiliation of its players, but also on the contexts in which it is displayed. I have laid the focus onto the actors of nanoart so far in order to outline the network structure of non-marketable art in the realm of art and science, and onto the objects of nanoart and specific aspects by which they are informed. The importance of Big Science for nowadays' societies as a major component in the understanding of this art leads from a discussion of the economic aspects behind an art form to the curatorial side and societal ascription of attributes. In the following, I am thus interested in exploring (nano)art's ascribed function and standing in the science educational context in which it is so often integrated.

Art in the Science Museum

Nanoart has usually been shown within specific frameworks, rarely singularly in a heterogeneous media art environment. Many nanoart exhibitions have taken place in science museums or other science-related contexts. In the past years, many science museums have opened exhibition spaces specifically consecrated to art and art-related projects. Next to the ongoing support of the arts with its Artist-in-Residence Program since the 1970s, San Francisco's Exploratorium hosts a "Seeing Gallery" which shows changing works of video and media art. Miraikan – Tokyo's new National Museum of Emerging Science and Innovation – has bestowed a whole post to a curator with a background in art and design in order to elaborate the museum's artistic engagement, culminating in the opening of its Laboratory for New Media. Likewise, London's Science Museum is running a program called Arts Projects currently directed by

[335] See e. g. the Tissue Engineering Workshops run by SymbioticA at the University of Western Australia. For an overview of several more projects cf. Reichle 2009.

Hannah Redler, a trained artist and curator. The question of art's status in this environment arises as nanoart is often presented in science-related exhibits (as is much of sci-art).

In Victoria Vesna's repudiation to make artworks "in the service of science" and the emphasis that her art is "not about nanotechnology", we encounter a common fear of instrumentalization of the arts. After all it is about the question of who is placed higher in the sovereignty of interpreting reality – art or science? While science museums want to "explore artists' perspectives on the past, present and future of science and technology, creating new opportunities for encountering contemporary art"[336], a "blend [of] the latest in information technology with creativity"[337], which role exactly is attributed to the arts and the artist in this context? In almost every text promoting art in a science-related environment – be it the laboratory or the science museum – we stumble upon the invocation of "inspiration and innovation"[338] and the artist's creative potential[339] combining "the analytical and experimental aspects of a laboratory with the artistry and creativity of an atelier"[340]. The artist is thus ostensibly endowed with capacities beyond the rational, a vibrant and fresh outlook onto the world which can be rendered useful in the science museum and the interdisciplinary laboratory. Rhetorics in this context always follow the same pattern: science is sober and rational, art is colorful and innovative. These characteristics of art – creativity and an eccentric perspective on reality – seem to be its *raison d'être* in the science-related environment.

However harsh the promoters of art in a science exhibition contest the instrumentalization of art and the reduction of art to a mere 'translator' of science thus assuming to be 'in the service' of the latter, the hierarchical disequilibrium between the 'two cultures' can hardly be argued out of existence. The mere fact that voices are incessantly raised to confront this very aspect conveys the key issue: that there simply *is* a socially firmly grounded hierarchy between one and the other culture. In modern society one culture – science – is generally attributed with the ultimate sovereignty of

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[336] Science Museum London, Arts Projects, www.sciencemuseum.org.uk/about_us/about_the_museum/art.aspx.

[337] Miraikan, Tokyo, www.miraikan.jst.go.jp/en/exhibition/ex3/anything.html.

[338] www.sciencemuseum.org.uk/visitmuseum/subjects/art.aspx.

[339] Cf. the Artists-in-Labs program at Zurich's University of the Arts: "The programme directors are seeking opportunities for cooperation with leading laboratories and intending to stimulate the creativity of the artists as good [!] as possible.", www.zhdk.ch/index.php?id=10691.

[340] See Ars Electronica's Futurelab, www.aec.at/futurelab_about_en.php.

interpretation; the other culture – art – is left for surplus experience and a less rigid inspection of the world.

Whether or not the protagonists of sci-art approve their art is at least partially involved in processes of illustration, translation, and even promotion of the (techno)sciences. If we go to a science museum and find art, the aspect of popularization of science through art is evident.[341] What it precisely means to 'translate' scientific contents in a science museum is another question. We may draw on Bruno Latour's analysis of the 'circulatory system of scientific facts' for this purpose.[342] Latour retraces the circulation of scientific content from field study or laboratory, via the communicational system of academia, the persuasion of funding bodies, up to public representation. This "fourth loop" of the public representation of science concerns issues fundamentally important for its societal status:

> How have societies formed representations of what science is; what is a people's spontaneous epistemology? How much trust do they place in science? How was psychoanalysis gradually absorbed into daily psychological discussions? How are DNA fingerprinting specialists faring on the witness stand?[343]

To which one might add: how is nanotechnology received by a Sunday morning Times reader? Which images of 'nano' are disseminated in science museums and popular media? Whatever be the intention of the artist, an artwork relating to nanotechnology presented in a science museum or a "Nano" exhibition at Los Angeles' County Museum of Art becomes part of science's efforts at persuading the public of its societal status.

Works like *Zerowave*, *Nano-Scape*, or *Midas Project* clearly partake in the popularization of nanotechnology – popularization here being a communicative process and a mediation of 'knowledge'.[344] On a textual level, it takes place not only in the description of the artwork on some plaque attached to the wall, but also via background information given in leaflets, catalogues, the Internet, and in the press. The "Nano" exhibition in São Paolo for example was complaisantly received by the press;

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[341] Whether or not a popularization by this means is more or less successful would be another question and would have to be subject to empirical research and visitor analysis.

[342] Latour 1999, 98-108.

[343] Ibid., p. 105.

[344] The quotation marks indicate the problematic definition of the term knowledge (cf. above on 'art as knowledge'). In this context, I shall drop the quotation marks and understand the term in its most general and customary sense.

Goldberg's and Böhringer's *flw* has been widely documented as show numerous articles on the artwork.[345] *Nanoscape* by Sommerer and Mignonneau was discussed in catalogues, the press, and even television.[346] The reader is usually provided with information on the genesis of the piece, the basic idea behind it, and technological aspects onto which the artwork is engrafted. The media art installation is thereby purposefully set in perspective.

As the artworks discussed here poetically revolve around nanotechnological details rather than conveying a critical potential, their promotional effect seems to be more ostentatious than their capacity to raise the public's awareness for the risks of technologies in the future. None of the works shows any deliberate skepticism toward the problematic status of nanoscientific (i. e. digital) images as postulated by a number of scholars.[347] None is essentially concerned with questions of visual and auditive transfer of research findings into the gallery space. The inaccessibility of the 'nanoworld' is put aside by tactile analogies. None of the artworks seems to be preoccupied with the physical or ethical risks in nanotechnological application. Instead, we encounter emblematic images of nanotechnology (the buckyballs in *Zerowave*), colorful atomic worlds and landscapes (*Midas Project*, *200 Nanowebbers*), and self-assembling atomic actors (*Nano-Scape*).

In the popularization of science, icons and emblems assume a pivotal role. Fullerenes, hexagonal structures and molecular 'webs', simulations of atomic 'behavior' – the anthropocentric frame of reference in imagining the nanoworld is not only central in scientific image production, but also for the transmission of scientific notions in media art. Buckyballs and crystalline structures tie in with the recipient's iconic background knowledge.[348] These non-textual components call for inspection.

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[345] See Andre Lessa, "A nanotechnologia em uma leitura poética", *O Estado*, São Paolo, 21.4.2008, online source: www.link.estadao.com.br/index.cfm?id_conteudo=13534; among several others see Peter Wayner: "House Hunters. 8 Rooms, 4 Baths, No Vu", *New York Times Magazine*, 10.3.1996, p. 21; Rupert Jenkins, "The Invisible Cantilever", *West – A Publication of the San Francisco Art Institute*, Winter 1996/1997.

[346] See Iglhaut/Spring 2003a; Ulrike Knöfel, "Sexgöttin in der Blutbahn. Forscher-Wunderwelt mal anders", *Der Spiegel*, 51/2002, 176-177; also discussed in "Nanowelt und globale Kultur", TV program "nano", broadcasted on *3sat*, December 16, 2002.

[347] See Heßler 2006, Mersch 2006, also Nordmann 2009.

[348] In their analysis of the discourse on vitamines and atoms in the 19th century, Arne Schirrmacher and Ulrike Thoms reflect on exactly this aspect of the recipient's previous knowledge: Arne Schirrmacher, Ulrike Thoms, "Neue Wissensofferten, alte Wissensbedürfnisse und verschiedene Transaktionsmodelle. Drei Thesen zum naturwissenschaftlichen Vermittlungsdiskurs", in: Sybilla Nikolow, Arne Schirrmacher, ed., *Wissenschaft und Öffentlichkeit als Ressourcen füreinander. Studien zur Wissenschaftsgeschichte im 20. Jahrhundert* (Frankfurt Main 2007), 97-109, p. 107-108: "It is obviously

Because the works cannot to be regarded as mere textual discourse, it is moreover the two other levels – images and bodily interaction – that constitute the particularity in the mediation of science taking place here. Image discourses[349] and their counterparts in the non-iconic connect not only to a linguistically mediated rational frame of knowledge, but also to the specific frame of *experience* of the visitor. Interdiscourses using collective symbols "offer spaces of images, metaphors, or analogies, which can then be of help linking multiple special discourses. […] The discourse is virtually regulated by the coining of terms and visual conceptions *in* science and *for* scientific mediation."[350] Here, the buckyball, the microscopic image, the crystal, emblematically stand for 'nano' as symbols for cutting-edge science per se. After theory has lately turned to materiality in discursive formations, and also to material matter in the history of science, it would be worthwhile accordingly to shed light on material aspects of knowledge transfer. This would not only be a materiality as represented by Ken Goldberg's silicon chip in *flw*, but also the materiality of perceivability and experience. Parallel to 'hands-on' installations in science museums, artworks on nanotechnology would then also allow a "participation *in* science".[351]

The question is if and how bodily involvement and knowledge communication converge in the nanoart works. How does the art public become a "sectoral public"[352] of science? How do science and emerging technology enter public spaces of communication?[353] With a huge number of artworks on science and technology, festivals like

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reasonable to form a link to historical discourse analysis, since the successful mediation of science is essentially a question of the possibility of a discourse, that is the possibilities of the sayable or the communicatable. And since terms like 'atom' and 'vitamine' have proven to be fundamental terms with significant symbolic content, with room for association and possible connections to previous social knowledge and convictions, which – in form of collectively grounded symbols – sooner or later become relevant for the discourse.".

[349] Along these lines cf. Karin Knorr Cetina on inner-scientific communication and the importance of the what she calls 'viscourse': "'Viskurse' der Physik. Konsensbildung und visuelle Darstellung", in: Heintz/Huber 2001, 305-320.

[350] Schirrmacher/Thoms 2007, p. 108-109.

[351] "The museum has to be understood not only as a space of mediation *of* science, but it now also serves the participation *in* science." Anke te Heesen, "Wissen als Exponat", *Gegenworte. Hefte für den Disput über Wissen*, Spring 2008, No. 19, 41-43, p. 41. See also Anke te Heesen, Petra Lutz ed., *Dingwelten. Das Museum als Erkenntnisort*, Schriften des Deutschen Hygiene-Museums Dresden, Vol. 4 (Cologne et al. 2005).

[352] Sybilla Nikolow, Arne Schirrmacher, "Das Verhältnis von Wissenschaft und Öffentlichkeit als Beziehungsgeschichte. Historiographische und systematische Perspektiven", in: Nikolow, Schirrmacher, ed., *Wissenschaft und Öffentlichkeit als Ressourcen füreinander. Studien zur Wissenschaftsgeschichte im 20. Jahrhundert* (Frankfurt Main 2007), 11-36, p. 12.

[353] See ibid. for an elaborate overview on the study of what was formerly 'popularization', today politically more correctly to be called 'communication' of or 'dissemination' of knowledge.

Ars Electronica, media art centers like Karlsruhe's ZKM, or NTT's InterCommunication Center in Tokyo, participate in the popularization of scientific knowledge, regardless of how 'sectoral' the visiting public may be. In this context metaphors bridging scientific essence and intuitive palpability play a major role, be they figurative, haptic, or textual. What Anja Casser discusses in her article on the popularization of science in the 19th century holds true for the media artworks too: they revert to similar motifs, symbols, and metaphors in order to integrate the abstract phenomenon of nanotechnology into already existant traditions of perception, connect it to daily experience.[354]

To my knowledge, there exists so far no analysis of art as a medium of scientific content.[355] Science museums have recently reacted to research in the educational sciences by widely incorporating 'hands-on' activities in their exhibition spaces. Their experiences in refining scientific knowledge for a lay public have led to the creation of new exhibition designs and learning environments, involving the visitor in novel and more active ways. "The crucial point [… here] is carefully designed in terms of visitors' meaningful interactions rather than in terms of increases in their canonical knowledge."[356] "Challenging the traditional authoritarian voice of museums", visitors are more and more often encouraged to "take pleasure in observing, playing, investigating, exploring, collaborating, searching, speculating" instead of being fed with graphics and textual information.[357] In shifting the authority from the museum to the visitors, playfulness and the layperson's curiosity have become central aspects in the transmission of scientific knowledge.[358] While museologists and researchers in

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[354] Anja Casser, "Künstlerische und technische Propaganda in der Weimarer Republik. Das Atelier der Brüder Botho und Hans von Römer", in: Nikolow/Schirrmacher 2007, 113-136, p. 118 and 129.

[355] Research on the dissemination of (scientific) knowledge in the museum has been propounded by scholars like Anke te Heesen: te Heesen 2005 and te Heesen 2008; Sharon MacDonald, *Behind the scenes at the Science Museum* (Oxford: Berg 2002); or Eilean Hooper-Greenhill, ed., *The Educational Role of the Museum* (London and New York: Routledge 1994).

[356] On Exploratorium's 'active prolonged engagement' (APE) exhibits: George Hein, "Foreword. The Importance of APE", in: Thomas Humphrey, Joshua Gutwill, ed., *Fostering Active Prolonges Engagement. The Art of Creating* APE *Exhibits* (Walnut Creek CA: Left Coast Press 2005), p. ii. The idea behind this goes back to earlier educational research, e. g. Shettel 1973: "active participation heightens the acquisition and retention of information", H. H. Shettel, "Exhibits: art form or educational medium?", *Museum News Washington*, 1973, 52 (1), 32-41, p. 40.

[357] Ibid.

[358] Hannah Redler, "From interventions to interactions: Science Museum Art Projects' history and the challenges of interpreting art in the Science Museum", *JCOM - Journal of Science Communication*, June 2009, Vol. 8, No. 2, online journal: jcom.sissa.it (Jul 6, 2010), p. 2.

educational science agree to the advantages of 'hands-on' mediation,[359] it is reasonable also to regard nanoart and interactive media installations against this background. A gallery visitor tossing around a simulated buckyball with his shadow, seeing it wobble and contract like in *Zerowave* might well be a common sight in a science museum. The simulation of atomic gaseous behavior in *Nano-Scape*, reduced to an 'invisible sculpture' which can be felt by the user of the installation, surely carries little more information than a meager awareness of the existence of an atomic sphere. What can actually be *felt* is just the magnetic effects and has nothing to do with 'nano'. In all of the artworks, it is thus rather a metaphorical translation of one field of reference (science) to another field of reference (human perception). The point I want to argue is that in alignment with recent museological research on the 'delighted visitor'[360] these media art installations take a similar path. Although nanoscientist James Gimzewski talks about bringing "science to all kinds of people" with his and Vesna's nanoart projects, it is probably Christa Sommerer who more aptly puts it when she talks about *Nano-Scape*: that the installation is not about displaying scientific data or information, but about artistically and intuitively familiarizing the public with a scientific subject.[361]

What exactly happens in the process of interaction between artwork and visitor? What does it mean, to 'perceive' a nanoscientific phenomenon? What are the translations or transformations that the scientific content is subjected to between lab and gallery? Not to forget what is *lost* in these processes of translation? In lieu of presenting well-grounded empirical research, the little literature there is on art in the science context contents itself with statements that art "acknowledge[s science's] uncertainty", brings about a different, subjective voice, and raises philosophical questions.[362] Due to the lack of data on how exactly artworks are perceived by visitors,

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[359] Cf. e. g. Roger S. Miles and Alain F. Tout, "Outline of a technology for effective science exhibits", in: Hooper-Greenhill 1994, 87-100; Nick Winterbotham, "Happy hands-on", in: Hooper-Greenhill 1994, 175-176.

[360] Cf. Hein 2005, p. ii, on visitor research on hands-on exhibits at Exploratorium: "By delighting visitors rather than confounding them, and by engaging them in personal inquiry broadly defined, [our] team has illustrated one way of supporting a progressive vision of education."

[361] Or – in the context of technology – with 'innovation' for that matter: cf. so-called Device Art in the science museum in the first chapter of this dissertation.

[362] Redler 2009, p. 3. See also Bergit Arends, "Contemporary arts in the Natural History Museum London: symbiosis and disruption", in: ibid.: "Artists' research addresses ambivalence around science and can bridge between the languages and strategies of display and the working processes of science. We hope to introduce notions of uncertainty about our knowledge […]." On the common ascription of the artist's role as critical observer within our 'knowledge society' cf. Mader (forthcoming).

one can only speculate upon the basis of research on 'hands-on' exhibits.[363] One could imagine a model recipient who would enter the gallery space, dimly lit. A soundscape might envelop him, he would be exposed to a visual input: to an abstract projection of a magnified skin cell, or to bluish buckyballs moving across the wall. He might stop, linger, and move on.[364] Or a user of *Nano-Scape* might take up one of the magnetic rings of the installation and scan the table's surface with her hand. She feels the repulsion of the magnetic field between her hand and the coils underneath the table. She might even have read some detail about the installation piece, about simulated atomic surfaces, and explain some of it to her bystanding daughter. Most of the visitors, however, will be completely or mostly uninformed about the artwork. However much information is given on websites or by exhibition leaflets, what will come across in their interaction with the media artworks will be little more in most cases than an impression, an awareness that he or she is experiencing the aura of something 'scientific'.

> [E]ven visitors who go to the art gallery expecting to raise questions and bring their own opinions come to the science museum expecting to be told what to think. And at the same time, they don't want to read 200 words about what to think. So it's really difficult to communicate why we've got art here, what the art is about, what the artist's wider practice might be, what's their conceptual legacy… You have to forget about wanting to communicate what is their conceptual legacy and the wider practice. All we can communicate in the number of words that visitors will comfortably read is: 'This is art. This is linked to the content here in this way. And this is what the piece is about.'[365]

Hannah Redler, the head of London's Science Museum Arts Projects, bluntly addresses the core problem of art in a science museological context. It is the issue of communicatability beyond the visual and bodily experience. Evidently, the attention span of the average visitor will not last much longer than to understand the gist of the artwork and move on.[366] The textual apparatus behind the works in leaflets, catalogues,

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[363] Cf. Humphrey/Gutwill 2005.

[364] "Visitors do not always recognise the art amongst these other interpretive and iconic materials [i. e. amongst the science exhibits in a science museum]." This statement follows research done in the Science Museum London, Redler 2009, p. 3.

[365] Hannah Redler in an interview, Science Museum London, April 14, 2010. Her statement is based on visitor research done at the Science Museum.

[366] Redler also brings to the fore the competition by various science museum exhibits for the visitor's attention: Redler 2009, p. 2.

even journal papers, does not protrude into the gallery space.[367] Like in 'hands-on' exhibits, it is the *experience* that counts, dealing with a scientific theme in whichever way. It might raise questions and curiosity, it might not. The user is in any case confronted with nanoscience through corporeal interaction with a media art installation.

Already the early years of emerging science involved the *object* as a mode of popularization. "To get to know the objects [of early experimentation], but also to touch them, to no longer content oneself with being a spectator of the sciences, but to operate with them, these were the preoccupations, sometimes linked in a contradictory manner […]."[368] Demonstrating the objects of science was one of the first means to motivate the public's engagement with science.[369] Amusement was as important as was instruction within the pedagogical framework of fairs and spectacles in the late 18th and throughout the 19th century.[370] These "lessons of things" were a way of approaching the layperson "by the sense", which became especially important in the 19th century when a huge amount of popular literature was now dedicated to the sciences.[371] The pivotal role of the object, of the sense of touch, and of a bodily connection to the material in popular science nowadays is therefore not astonishing. Rather, the concept of 'hands-on' accords a prominent status to experience as has been the case with earlier 'instruction through the object'.

There are significant disparities between exhibiting objects of experimentation and science exhibited through art. In the first case, parts of the epistemic apparatus serve as a sample for demonstration while in the nanoart installations a scientific 'fact' or 'information' undergoes steps of translation (or a chain of transformations, to say it with Latour). At the end, the chain is strongly diffracted up to the point where

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[367] Cf. James Leach's reflection on the necessity of the "textual and the explanatory" as being "central to the work" in sci-art. Examining the work of the artist Simon Biggs, Leach concludes: "in fact, I suspect that without Biggs's explanations of his vision and reason, much of it would remain inaccessible." James Leach, "'Being in Between'. Art-Science Collaborations and a Technological Culture", *Social Analysis*, Vol. 49, Issue 1, Spring 2005, 141-160, p. 145.

[368] Daniel Raichvarg and Jean Jacques, *Savants et ignorants. Une histoire de la vulgarisation des sciences* (Paris 1991), p. 194.

[369] Ibid.

[370] "Les étendards mêlés de l'instruction et de l'amusement, du merveilleux et du pédagogique flottent au-dessus des activités de la majorité des entreprises de spectacles scientifiques.", ibid., p. 219.

[371] Ibid., p. 227. See also te Heesen 2008 and Peter Damerow and Wolfgang Lefèvre, "Wissenssysteme im geschichtlichen Wandel", in: Friedhart Klix, Hans Spada, ed., *Wissen* (Göttingen et al. 1998), 77-113, p. 94-95. Damerow and Lefèvre point out the consequences following the segmentation of knowledge into specialized knowledge during the 19th century, leading to its disconnection from daily experience.

referentiality is almost lost. If scientific images or amplified sound data enter the art space, they might still be viewed as exhibited objects of science. If, however, nanoscience is depicted in the form of emblematic carbon molecules in simulated movement, or as magnetic fields to be perceived by touch, the medium of translation in this case diverges quite radically from its point of reference. Referentiality is then only given on a metaphorical level – with an inevitable loss of 'knowledge' or 'factuality'. The metaphor, the image, or the non-visible emblem, become stakeholders of science. 'Nano' is introduced as a label – *Nano-Scape*, *Nanowebbers*, *Nano_essence* – and is indeed presented as some kind of an 'essence', a distillate of a bigger scientific system behind it.

"Science states meanings; art expresses them."[372] For the educational reformer John Dewey, science and art revolve around the same core; they only light it from different angles. His reflections on "art [as] an immediate realization of intent"[373] are based on ideas that will later be taken up by rhetorical tropes in the context of 'art and science'. While Dewey's view is tightly linked to ideals and utopias of modernism, it is remarkable how his conception of art sublimating life and "amplifying" experience is still reflected in today's media art rhetorics.

> [I]n both production and enjoyed perception of works of art, knowledge is transformed; it becomes something more than knowledge because it is merged with non-intellectual elements to form an experience worth while as an experience.[374]

Similar ideas are still at work today. I shall analyze these topoi of modernity more in-depth in the third chapter of this book. At this place, I am interested in the key term 'experience', not in rhetorics of art's role in daily life. When Dewey writes that art *expresses* a 'meaning' which science merely *states*, his statement runs parallel to claims asserted in interactive art as well as art in a science context. Along with these postulations, certain characteristics are ascribed to art, a capacity to engage the audience in novel ways. It is tempting to juxtapose Dewey's belief that the "scientific method as now [in the 1930s] practiced is too new to be naturalized in experience"[375] with Sommerer's and Mignonneau's endeavor of an "intuitive experience where users

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[372] John Dewey, *Art as Experience* (New York 1934), p. 84.

[373] Ibid., p. 85.

[374] Ibid., p. 290.

[375] Ibid., p. 338.

can interact with invisible self-organizing atoms". To ascertain what this 'intuitive experience' could be is difficult, even impossible. It is noteworthy, however, to bring to awareness the seemingly inevitable connection of art, science, and experience. Dewey's insistence on a sublimated experience through art prevails in great part unbroken today. Media artists, curators, theoreticians try to approach the metaphysical realm behind science and the art by the obvious interface: the beholder's experience. Experience and intuition constitute the nucleus of art's ascribed capacities in this context – capacities awaiting ever-renewed appraisal.

Science education with its 'hands-on' approach and interactive art converge in the assertion that the beholder is now much less part of a passive mass. This does not answer the question in which way 'meaning' or 'knowledge' are conveyed in this context. "[T]o bring the theme of 'Nanotechnologies' closer to the public awareness"[376] is surely something artworks like *Nano-Scape*, Vesna's and Gimzewski's projects, or Paul Thomas' work, participate in. Yet science museums' art spaces are established in the hope that art in this context can do more than just carry a theme into the exhibition space. Accordingly, 'experiencing' science would then be as much part of its popularization as learning about scientific 'facts'. An assessment of an artistic *experience* of scientific concepts and its value remains a question not only of further empirical research, but also of perspective and educational vision.

Rhetorics and aspirations around art's function in the science educational context span from the promotion of the 'active visitor' to the invocation of "new kinds of knowledge production". [377] Anthropologist James Leach nicely summarizes the significance of art and science meeting in collaborative projects which can be extended to our case of art in the educational science environment: "Thus, there is an impetus to insert the publics, users, and arts and humanities disciplines, as representatives of different social understandings, into the process of technological development. […A]rt-science collaborations […] do not mediate between the realms of arts and sciences. Rather, they mediate between technology and society, or even between people and their perception of a 'runaway' technological culture."[378] This is what I mean when I understand 'experienced science' as a specific form of promotion of science. Nanoart is certainly part of this process of mediation between science,

[376] Sommerer/Mignonneau 2005, p. 200.

[377] Cf. critically on this Leach 2005, p. 142.

[378] Ibid., p. 148 and 153.

technology, and society – a process in which are engaged artists, curators, and funding bodies alike.

3. Beyond popularization: Auratic Science

In a lot of contexts, 'nano' serves as a label more than relating to a specific nanotechnological content. After nano in after-sun lotion, nano in cookware, there is also nano in art. 'Nano' is evidently not only a way of positioning a player in the booming field of 'art and science', a way of attracting funding to partake in single or group exhibitions, it is also a subject of imminent societal relevance. For decades, art has been calling for an active engagement with technology. From Italian Futurism, the *Experiments in Art and Technology*, to media art in the 21st century, voices have time and again been raised against artistic hesitation and even rejection of science and technology. Overcoming the trench between culture and science has been celebrated by 'art and science' as often as it has been produced and reproduced before and after C. P. Snow's famous lecture.[379] What is striking here is less the phenomenon of art parallelizing social developments. Art as part of a societal system is not independent from others. Rather, its very status and significance as a social pillar is defined by its reflection of present conditions. In an arena where funding is not abundant, in times of 'information societies' in which technology and the 'knowledge economy' have long outrun the industrial era, also artists and curators naturally turn to red-hot subjects like the technosciences. Regarded from a sociological perspective, artistic affiliation, strategic positioning in a funding context, and the popularization of technoscience all meet in one focal point.

Yet interactive nanoart does not content itself with the mere presentation of STM images or modified sonic data. Instead, the technological is transfered into the metaphorical. This is where the scientific chain of transformation is strongly bent, where referentiality receives a fissure. The travelling content is no longer only transferred into another medium, but into another mode of representation. Gimzewski's every-day nanoscientific research is linked to microscopic images, to ideas of an atomic composition of the world. The step his and Vesna's art projects take from there to a sand mandala, to an STM image of a single grain, and finally to Buddhism,

[379] E. g. "[O]nce opposing worlds of art and science have finally been united in a spell-binding blend of inspiration and innovation", www.sciencemuseum.org.uk/visitmuseum/subjects/art.aspx.

departs from its initial referent and takes the beholder onto novel grounds. Also Niemetz and Pelling specifically aim at this sphere beyond the scientific. Thomas and Raxworthy address Greek myths, questions of humanness, of "life and death"[380]. Every single one of the works presented here is somehow dealing with nanotechnology. Yet besides that each one pivots around yet another significant theme.

Not without good reason, Stefan Iglhaut and Thomas Spring cite Niklas Luhmann on the necessity of a "parallel poetry" accompanying the scientific. With their itinerant exhibition "Science + Fiction. Between nanoworlds and global culture" shown internationally at renowned venues, the two curators want to take a position which reaches above the mere presentation of science: which moreover displays multiple artistic prospects of 'science' and thereby turns art into a voice beyond the scientific statement.[381] The "parallel poetry" lies in this 'beyond'.

Science – in our case nanotechnology – serves as a reason for a contemplation on life and for art's surplus to unfold. In the interactive installations we encounter an impetus to incite the user's sensitivity toward philosophical questions, to stage Buddhism in an art gallery, to introduce the mysterious. The artists do not raise spiritual questions without any presupposition, but with a common point of origin: the nanosciences. If the artworks are not about nanotechnology, or at least just as much about spirituality, what is the role that science plays in this art? Nanoart being paradigmatic 'art and science' uses scientific trunks onto which it engrafts a lyrical superstructure. Two things nourish the metaphysical experience of the works. Nanoart revolves around unperceivable facets of our world, around the exploration of invisibility as a driving force in scientific history. At the same time, it attires itself with science's aura. In the following, I shall elaborate on these two aspects.

When in the early 20th century quantum mechanics and the theory of relativity revolutionize modern science, the new areas of research consolidate science as "a sphere far removed from ordinary life".[382] Popularization now struggles to bridge the

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[380] crash.curtin.edu.au/research/nano.cfm.

[381] Stefan Iglhaut, Thomas Spring, "Science + Fiction. Wie sich Wissenschaft und Phantasiewelt durchdringen", in: Iglhaut/Spring 2003b, 15-23, esp. p. 17-18. "In the art context, a scientific content is turned into a cultural sign; and only in form of a cultural sign [artists] can express something like Luhmann's *Weltstimmungsgehalt*.", ibid., p. 17.

[382] Bernadette Bensaude-Vincent, "A geneology of the increasing gap between science and the public", *Public Understanding of Science* (2001), Vol. 10, No. 1, 99-113, p. 109.

gap and technology becomes one of the most important links between the remote domain of science and the world of ordinary experience.[383] "So significant has the rhetoric of technology become to making science relevant and important that the technological has sometimes eclipsed the scientific, just as the scientific once began to obscure the harmonious world of truth that formerly stood behind all specific forms of human knowledge." [384] The technosciences, as a research area connecting the production of abstract knowledge with the devices used for that purpose, testify to this aspect.[385] Within the technosciences, nanotechnology operates on a level hardly accessible by human imagination. As discussed above, its image production entangles the world of experience and abstract ideas through a novel type of microscopy which is strongly reliant on representational decisions. While scientific devices like the *nanoManipulator* are conceived in order to make use of intuition and human perceptibility of nano-scale operations, media art approaches the subject from a similar angle in addressing the intuitive. To come back to the issue of popularization: the artists offer another member in the chain of scientific processes of translation and tranformation, passing on scientific knowledge however diffuse it may be.[386]

The characteristic of invisibility provides the artworks' matrix. The hiatus between abstraction and human experience turns nanotechnology into an attractive field for questions reaching beyond the scientific 'fact'. Invisibility and imagination in science naturally open up space for speculation, musing, and mystery. Not only do exhibition titles reflect the significance of the inaccessible.[387] It is also displayed by the context of the works.

Among others, Adriana de Souza e Silva has adverted to the fact that emerging nanotechnology is always about imagined realities and thereby about the "the

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[383] Thurs 2007, p. 92.

[384] Ibid., p. 180.

[385] Ibid.

[386] Cf. Hans-Jörg Rheinberger on the invisible and on processes of transformation in science: "Geht es bei einer wissenschaftlichen Darstellung darum, 'Unsichtbares' 'erkennbar' zu machen, etwas Verborgenes nur zu entdecken? Handelt es sich um ein Versteckspiel? Oder haben wir es mit einem Vorgang der 'Übersetzung' zu tun, was ja im wörtlichen Sinn bedeutet, Zeichen in andere Zeichen, Spuren in andere Spuren zu transformieren? Oder geht beides Hand in Hand?", Hans-Jörg Rheinberger, *Experimentalsysteme und epistemische Dinge. Eine Geschichte der Proteinsynthese im Reagenzglas* (Göttingen 2001), p. 109.

[387] "In the Land of the Lilliputian. Artists Visualize the Very Small" at Exploratorium in 2006, "Territoires Invisibles" at the Maison Européenne de la Photographie, Paris, in 2007.

existence of unknown and distant worlds".[388] This connection between invisibility and imagined spaces brings along several implications for science as well as for the mediation of scientific knowledge. The nanosciences are targeted at invisible worlds.[389] Nanotechnology (and what is subsumed under this term, respectively) creates an imaginable space, picturing it via an image production which is itself a constitutive part of the research process. "Visualizing an invisible object means to create a view onto this object" and 'view' implies existence: "the [scientific] image reveals reality".[390] More than other scientific areas, the nanosciences present themselves as a window into an unseen world. Imagination becomes central to the point where fiction takes over.[391]

The invisible, the inaccessible, the idea of hidden worlds informs the artworks' poetical surplus. A tension between invisibility and scientific 'truth' underlies the images. They "seem to make the invisible visible and evident in a way that has been ascribed to religious, scientific, and artistic images throughout the ages in order to make them credible in their service to the idea, to God, to the spiritual, or to truth".[392] The discursive body around the artworks speaks of "surrounding sound immers[ing] the visitor into the world of nano"[393], "a plunge into the invisible universe of nanotechnology"[394]. Artists and curators want us to "experience […] events at an

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[388] Adriana de Souza e Silva, "The Invisible Imaginary. Museum Spaces, Hybrid Reality and Nanotechnology", in: Hayles 2004, 27-46, p. 40.

[389] Cf. also Peter Geimer's reflections on 'photography of the invisible' in roentgenograms around 1900. His remark on their creation of a 'space of knowledge' could also be seminal for nanotechnological research (and inevitably linked to that: nanotechnological image production): Peter Geimer, "Einleitung", in: Peter Geimer, ed., *Ordnungen der Sichtbarkeit. Fotografie in Wissenschaft*, *Kunst und Technologie* (Frankfurt Main 2002), 7-25, p. 14.

[390] Gernot Grube, "Digitale Abbildungen - ihr prekärer Zeichenstatus", in: Heßler 2006, 179-196, p. 193 and 183.

[391] On the role of fiction in nanotechnology see de Souza e Silva 2004; N. Katherine Hayles, "Connecting the Quantum Dots: Nanotechscience and Culture", in: Hayles 2004, 11-23; José López, "Bridging the Gaps: Science Fiction in Nanotechnology", in: Schummer/Baird 2006, 327-356; Martin Roth, "Wissenschaft und Kunst - nur ein Flirt oder unglückliche Liebe? Ein Gespräch mit Stefan Iglhaut", in: Iglhaut/Spring 2003a, 20-25.

[392] Jörg Huber, "On the credibility of world-pictures", in: Bruno Latour, Peter Weibel, eds., *iconoclash. Beyond the Image Wars in Science, Religion, and Art*, exh. cat. (Cambridge MA 2002), p. 520. Huber leaves open the question concerning the referentiality of digital research images. Accordingly, cf. Boris Groys' remarks linking the digital image to the theme of representing the invisible in Byzantine icons: Groys in a conversation held in April 2007 within the framework of the Art Seminar, in: James Elkins, David Morgan, eds., *Re-Enchantment* (New York and Abingdon 2009), p. 120.

[393] On the "Nano" exhibition at LACMA, nano.arts.ucla.edu/i_inner.php.

[394] On "Nano" in São Paolo,www.faap.br/hotsites/hotsite_nano/interna.html.

atomic level"[395], "make [us] feel like [we] were in a nano-scale world"[396], "explore […] parallel and immaterial worlds which surround us"[397]. Ken Goldberg sees the concept of 'telepistemology' reflected in his microscopic work *flw*, when he asks "how distance influences belief, truth, and perception".[398] Vesna and Gimzewski "propose the interactivity to be stillness for in this empty space of nano we can get in touch with the magic of continuous change",[399] while Niemetz and Pelling see "much mystery" in the "sounding universe" of *The Dark Side of the Cell.*[400] For nanoart, nanotechnology has opened new spaces of poetical ambiguity. The unknown and the unseen is presented in poorly lit, enigmatic rooms. Electronic music engulfs the visitor. The very small is contemplated with wonder.

Science has always been concerned with the unknown and the unexplored. Mysterious uncertainty in a sphere far from every-day experience encourages explorations touching upon fields of belief and miracle. Next to the illumination of the invisible in nanoscientific contexts, nanoart benefits from the exploratory spirit ascribed to science. Daniel Thurs has shown how 'science' has always been functioning as a linguistic and cultural category of considerable importance. Becoming "*the* source of cognitive authority"[401], science has accumulated a cultural prestige outmatched by hardly any other societal entity. In the late 18th century, science emerges as a separate category playing an eminent role in society. By the 20th century, the "otherness of science" is consolidated to a point where its remoteness grants an unrivaled sense of discursive power.[402] The label of the 'scientific' soon ennobles whichever object it adorns. Yet the societal status of science remains a complex one. Along with its cultural supremacy comes critique and rejection. The concept of 'two cultures' emerging in modern times – with science on the one hand and the humanities on the

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[395] Thomas 2009, p. 186.

[396] Ruth Jarman on *200 Nanowebbers*, eternalgaze.net/2006/06/200-nanowebbers-semi-conducted/.

[397] On "Territoires invisibles" in Paris, www.art-outsiders.com/archive_2007/index.html.

[398] Ken Goldberg, "Telepistemology and The Aesthetics of Telepresence", on: www.walkerart.org/gallery9/beyondinterface/goldberg_artist.html. In this artist statement, Goldberg quotes the same passages as when he refers to *flw*: human perception and framed vision, Descartes' musing on truth and reality.

[399] On *Blue Morph*, artsci.ucla.edu/BlueMorph/main.html.

[400] www.darksideofcell.info/singingcell.html.

[401] Barry Barnes, David Edge, eds., *Science in Context. Readings in the Sociology of Science* (Cambridge: MIT Press 1982), p. 2.

[402] Thurs 2007, p. 11, 92.

other – represents the factual and discursive struggle for power by science and its adversaries.[403] However harsh though criticism and arguments may be, science stands firmly as one pillar of nowadays' self-image.[404]

Sovereignty of interpretation, questions about truth and reality are prolongated into the realm of scientific images. Especially in the nanosciences, images transfer "statements of probability into something seemingly definitive and (visually) assertive". Uncertainty (in terms of Heisenberg) is not representable.[405] The persuasive power of nanotechnological visualizations lies in the image's evidentiary characteristic. "There is no subjunctive image. Whatever reveals itself, reveals itself without reserve. This is why images have always had a special relation to testimony. It predestines their function of evidence, of a 'proof of existence'."[406] The nano-technological image speaks to us not as a construction, but as professed evidence of atomic surfaces with a certain appearance. 'This is science, this is real' is the message lying in the digitalized presentation of inaccessible realms. The same holds true for sound data as employed in works like *Blue Morph*. What we hear is essentially nothing more than the vibration of the tip of a cantilever. In the computer, this low-frequency vibration is transposed into a frequency range perceptible by humans, then amplified and emitted via speakers. With their artwork the authors imply that this is real science, that we are actually listening to the substantial metamorphosis of a pupa, to yeast cells, to skin touching gold. All is based on science. It putatively brings us closer to something inaccessible yet existent, provides a nexus with the remote. Science's authority is interlaced with its artistic essence. For players in the 'art and science' field science serves both as a springboard for philosophical elaboration and as authoritative voice. For the big promoters and funding bodies of sci-art – academia, national science programs, and science-related foundations – buzzing nanotechnology represents a well-working label. The tag 'science' ennobles the artwork and its exhibiting context.

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[403] Cf. Snow 1959; even earlier Dewey 1934; critically Helmut Kreuzer ed., *Literarische und naturwissenschaftliche Intelligenz. Dialog über die "zwei Kulturen"* (Stuttgart 1969).

[404] See also Chris Toumey, *Conjuring Science. Scientific Symbols and Cultural Meanings in American Life* (New Brunswick 1996). Following Clifford Geertz, Toumey analyzes science as a matrix of meanings and symbols, and retraces its institutional authority in US-American society.

[405] Martina Heßler, "Die Konstruktion visueller Selbstverständlichkeiten. Überlegungen zu einer Visual History der Wissenschaft und Technik", in: Gerhard Paul ed., *Visual History. Ein Studienbuch* (Göttingen 2006), 76-95, p. 89.

[406] Mersch 2006, p. 413: "Kein Bild argumentiert konjunktivisch. […] Was sich zeigt, zeigt sich vielmehr rückhaltlos, weshalb Bilder seit je eine besondere Beziehung zur Zeugenschaft unterhielten. Das prädestiniert ihre Funktion für den Beleg, den 'Existenzbeweis'.".

Much more important than science's suggestive power is the *void* science leaves open for 'art and science' to step in. Not only is science often conjured in order to benefit from its powerful symbols.[407] There are also common tropes and topoi which frequently accompany the scientific and contrast science's sober attire. Because science in modern times has in many ways taken the place of religion it has retained ascriptions that are tangent to the powerful mystical.[408]

I have already employed the term 'aura' and 'auratic' in order to describe something emanating from science. The term will become even more important in the third chapter of this dissertation and will be contextualized and discussed in depth. At this point, I understand the auratic in a deliberately pre-Benjaminian sense. I use it according to its colloquial connotation stemming from a pre-modern religious-metaphysical worldview in which the aura relates to a "transcendentally legitimizing authority".[409] The auratic hence is connected to a nimbus of power which is accorded by a social, often transcendent entity, "or it arises from a situative framework and due to the social role into which is embedded the auratic object".[410] Talking about the 'aura of science' I refer to the air of transcendental authority which science has assumed in modernity.[411]

When Max Weber spoke about the 'disenchantment of the world' in modern times, he developed his argumentation out of a reflection upon the process of rationalization and intellectualization "which we have been undergoing for millenia".[412] Science as an authority "alien to god" has taken the place "incalculable powers" and spirits once

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[407] See Toumey 1996.

[408] This is also reflected in the depiction of science in contemporary fiction like film and other mass media. See Peter Weingart on scientific myths in the movies: "Von Menschenzüchtern, Weltbeherrschern und skrupellosen Genies. Das Bild der Wissenschaft im Spielfilm", in: Iglhaut/Spring 2003b, 211-228; also Sarasin's remarks following Lacan's conception of 'l'Autre': Philipp Sarasin, *Geschichtswissenschaft und Diskursanalyse* (Frankfurt Main 2003), esp. p. 249-257.

[409] Peter M. Spangenberg, "Aura", in: Karlheinz Barck et al., eds., *Ästhetische Grundbegriffe: historisches Wörterbuch in sieben Bänden*, Vol. 1 (Stuttgart: Metzler 2000), 400-416, p. 400.

[410] Ibid., p. 401.

[411] Although none of the following scholars specify their understanding of the term, I employ it here as do Lorraine Daston and Peter Galison when they analyze the ideological power of early X-ray photography, its nimbus of infallibility, and its "aura of supernatural capabilities": Lorraine Daston, Peter Galison, "Das Bild der Objektivität", in: Peter Geimer, ed., *Ordnungen der Sichtbarkeit. Fotografie in Wissenschaft, Kunst und Technologie* (Frankfurt Main 2002), 29-99, p. 77. Accordingly, Christoph Asendorf uses the term speaking about cybernetics and the "aura of expectancy" ("Aura der Erwartung") ideologically connected to them: Christoph Asendorf, "Die Künste im technischen Zeitalter und das utopische Potential der Kybernetik", in: Michael Hagner, Erich Hörl, eds., *Die Transformation des Humanen. Beiträge zur Kulturgeschichte der Kybernetik* (Frankfurt Main 2008), 107-124, p. 124.

[412] Max Weber in Lassman/Velody 1989, p. 13.

inhabited.[413] Against the background of a highly anti-intellectual youth (in 1917) longing for "religious experiences", Weber struggles to point out science's 'meaning' ("Sinn") in a disenchanted world in which especially "the ultimate, most sublime values have withdrawn from public life, either into the transcendental realm of mystical life or into the brotherhood of immediate personal relationships between individuals. It is no accident that our greatest art is intimate rather than monumental […]".[414] Throughout the lecture the sociologist incessantly contrasts science with 'art'. Art's character is perceived as being twofold. On the one hand, the artist completely and purposelessly serves the matter, that is, art. In this aspect the artist equals the scientist. On the other hand, in contrast to science art does not know 'progress'; a real artwork never becomes obsolete.[415] Investigating the societal status of science, Weber analytically circles around four quintessential fields: meaning, art, progress, and the spiritual. It becomes clear that the process of intellectualization as symbolized by science leaves blank spaces to be filled differently now. Weber's speech is an early example of the prevalent discursive entanglement of science, the sublime, and art. Although he does not state it explicitly, it is incontestable that the voids created by the modern belief in the scientific are replenished not only by the religious quest of the youth, but also by the artistic sublime.

21st-century 'art and science' is doing something very similar. Where science intersects with philosophy, art jumps into the void to be filled lyrically. For this purpose, it applies a recurring principle: prolific analogies. By this I understand the act of setting a theme or an idea in relation to another seemingly similar yet metaphorically open theme or idea. Ken Goldberg and Karl Böhringer for example follow this scheme in their microscopic piece *flw*.

> Why Fallingwater? Wright employed the cantilever: a horizontal structure for distributing force, 'the true earth-line of human life' (Wright). Cantilevers are also used to measure forces in miniature devices etched from silicon.[416]

While Frank Lloyd Wright is one of the first architects to use cantilevers in buildings, Goldberg and Böhringer present the technique "at the center of another paradigm shift"

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[413] Ibid., p. 17 and 13. In the English translation on p. 17, Weber's original "gottfremde Macht" has been translated by "irreligious power" which carries somewhat different connotations.

[414] Ibid., p. 30.

[415] Ibid., p. 11-12.

[416] www.ieor.berkeley.edu/~goldberg/flw/.

in silicon devices.[417] Engineer and media artist Goldberg tops off the artwork's presentation with a citation of Descartes reflecting on observation and truth. The prolific analogy of the cantilever accounts for the rhetoric balancing act between iconic architecture and industrial engineering; microscopic dimensions entail the desired link to philosophical pondering on the real versus the artifact, on perception and truth.[418]

Nano-Scape by media artists Sommerer and Mignonneau sets the imperceptible atomic in relation to the "intuitively accessible" – that is, touch. Invisible landscapes of electromagnetic repulsion serve as analogy to "interactions of atoms […] on a nano-scale level"[419]. K. Eric Drexler's early vision of "strange futures, holding worlds beyond our imagining"[420] now becomes seemingly palpable in the art gallery. In order to avoid distracting the user "from feeling the atomic forces"[421], the artists ban the monitor visualizing atomic simulation from the installation space. Without much visual input, the users can extend their hands over the table surface and experience the auratic of spiritualist 'nano' (that is, magnetic forces in this case). Also here, nano is allegedly rendered accessible by art through a series of analogical equating.

The Australian artist Paul Thomas draws on Drexler in order to elaborate on another analogy – the myth of King Midas and the golden touch. Thomas' *Midas Project* endeavors to explore the "boudaries of our body as it makes physical contact with the world around us".[422] The touch of gold, nanotechnology, and debates of techno-humanism all are intermingled in the discursive framework of *Midas*. "The order in time that Bergson referred to in his 1889 paper can now be understood as synonymous with the action of the AFM in contact mode."[423] Analogies of touch inform the lyrical background of the artwork, Henri Bergson serves as philosophical authority, original nanotechnological data open up a cursory discussion of 'humanism'. Thomas' work is

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[417] Jenkins 1996/1997, no pag.

[418] "Although the senses occasionally mislead us respecting minute objects, such as are so far removed from us as to be beyond the reach of close observation, there are yet many other of their informations, the truth of which it is manifestly impossible to doubt; as for example, that I am in this place, seated by the fire, clothed in a winter dressing gown, and that I hold in my hands this piece of paper...." Descartes, Meditations, often cited in the textual framework of the installation piece and on Goldberg's website: www.ieor.berkeley.edu/~goldberg/flw/.

[419] Sommerer/Mignonneau 2005, p. 203.

[420] Drexler's 1986 novel *Engines of Creation. The Coming Era of Nanotechnology* cited in ibid.

[421] Ibid.

[422] Thomas 2009, p. 187.

[423] "When, with our eyes shut we run our hands along a surface, the rubbing of our fingers against the surface, and especially the varied play of our joints, provide a series of sensations, which differ only by their qualities and which exhibit a certain order in time." Bergson cited in ibid., p. 190.

representative for sci-art in general as it uses a technoscientific trunk in order to elaborate on poetic or philosophical "questions". Science's social and philosophy's discursive authority are merged; beyond the visual, transcendental spaces standing ajar become art's surplus.

Thomas' and Raxworthy's *Nano_essence* with its breath interface is aimed at drawing the visitor into thoughts about nanotechnology's "implications for metaphysical understandings of our world and its life forms" and makes reference to "breath itself being strongly associated with Biblical conceptions of life".[424] Here, we are not far from the entanglement of science, spirituality, and art of Weber's days.

More explicitly than other artists, Vesna and Gimzewski introduce spirituality in their artworks. Science still functions as a legitimizing force when we are informed that the glowing buckyballs in *Zerowave* supposedly relate to Einstein's theory of relativity ("Nothing is solid, not even a rock").[425] Allusions to Albert Einstein of this kind represent little more than a common means of adorning one's cause with intellectual gravity. *Nanomandala* or *Blue Morph*, however, are forthrightly conceived around transcendental issues more than around a communicatable aspect of 20th-century science. A "meditative soundscape" by Anne Niemetz accompanies the sand mandala created by Tibetan Buddhist monks.

> This coming together of art, science and technology is a modern interpretation of an ancient tradition that consecrates the planet and its inhabitants to bring about purification and healing.[426]

The analogy here bridges a grain of sand in a mandala and the world shaped by atoms at the nanoscale. The reference to New Age ideas and Buddhism links disenchanting science back to the metaphysical realm.[427]

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[424] crash.curtin.edu.au/research/nano.cfm.

[425] notime.arts.ucla.edu/zerowave/projection.html.

[426] *Nanomandala* at art venue Location One, New York City, Dec. 2004 - Jan. 2005, www.location1.org/victoria-vesna-nano-mandala/.

[427] As mentions Shanken, such a reference to "ancient systems of knowledge" is nothing new in media art. On artist Nam June Paik drawing a parallel between Buddhism and cybernetics, cf. Edward A. Shanken, "Cybernetics and Art. Cultural Convergence in the 1960s", in: Bruce Clarke and Linda Dalrymple Henderson, eds., *From Energy to Information. Representations in Science and Technology, Art*, and Literature (Stanford: Stanford Univ. Press 2002), 255-277, p. 268-269. See also Volkhard Krech on mystical and sakral dimensions in video art, and specifically on Nam June Paik's *TV Buddha*: "Kunst und Religion", in: Birgit Weyel, Wilhelm Gräb, eds., *Religion in der Lebenswelt. Erscheinungsformen und Reflexionsperspektiven* (Göttingen: Vandenhoeck & Ruprecht 2006), 101-117, p. 115-117.

As shown above, *Blue Morph*, created four years after *Nanomandala*, is perceived to encourage "meditative states", bringing "good energy", to "propose […] stillness for in this empty space of nano we can get in touch with the magic of continuous change"[428]. The "empty space of nano" here supposedly can be accessed by interacting with the artwork. "Magic" lies in the metamorphosis of a butterfly which we may 'experience' in meditation. Science here helps us perceive the world as an enchanted one again.

The para-religious in Vesna's and Gimzewski's works stems from extra-Western forms of spirituality. In a conversation held on the topic of religion's role in art, scholars Tomoko Masuzawa, Boris Groys, James Elkins, and Thierry de Duve agree to the general impression that the Western art world is generally rather embarrassed with an overt display of religious sentiment. Masuzawa calls for a historicization and de-essentialization of 'the religious', bringing to mind that "'religion' remains essentialized, un-historicized, un-analyzed."[429] Masuzawa refers to religion as a discursive regime in this context, de Duve utters outright skepticism toward religiosity in contemporary art.[430] It is striking to see the mechanisms at work when it comes to the integration of extra-Western 'spirituality' into Western sci-art.[431] Science's ascribed capacity to access remote worlds and its aura of mystical 'otherness' is complimented by New Age ideas of Buddhism and 'meditation'. Vesna and Gimzewski integrate nanoscience and spirituality in their characteristic way which encompasses both a certain dramaturgical form of multimedia installation and the design of the corresponding websites. Art becomes "a spiritual vehicle"[432] in dark spaces filled with numinous soundscapes, in a mise-en-scène where visitors seem to close their eyes in devotional experience.

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[428] artsci.ucla.edu/BlueMorph/concept.html.

[429] …"The only thing I know that's worse than 'religion' in this respect is 'spirituality', which has a much more recent birth date – in the 1970s, as far as I know." Masuzawa in a conversation held in April 2007 within the framework of the Art Seminar, in: Elkins/Morgan 2009, p. 124.

[430] de Duve in: Elkins/Morgan 2009, p. 161.

[431] Ibid. !: "I must admit that I am a lot less critical vis-à-vis religiosity in art […] when I deal with non-Christian art. Indian art […] is a case in point." Accordingly, it is unimaginable that Vesna's and Gimzewski's work would have gained the same notoriety had it been addressing Christian spirituality.

[432] James Elkins, *On the strange place of religion in contemporary art* (New York and Abingdon 2004), p. 18.

While the conceptual is essential for all media art,[433] reference to extra-scientific issues, to the 'philosophical', is constitutive for artworks of 'art and science'. A glance at interactive nanoart illustrates how the transcendental, the sublime, the auratic resurface as categories historically innate to the artwork.[434] Science in turn is staged in its quality of reaching beyond the visible, entering spaces transcending experience but not human knowledge. As art and science are both concerned with investigations of real and virtual worlds,[435] the metaphysical surplus in their proclaimed union does not come as a surprise.

In this spirit, Sommerer and Mignonneau encourage the user to touch *Nano-Scape*'s 'invisible sculpture' in reference to imperceptible atomic landscapes. Extended hands and closed eyes evoke the auratic experience of spiritualist gatherings. In the same spirit, the visitor is immersed in the sombre atmosphere and mystic "cell sonics"[436] of Niemetz and Pelling's *The Dark Side of the Cell*. There is something at work here which Boris Groys calls "the sacralization of a certain space" in installation art.[437] In the artworks, science's aura fuses with the auratic of the artwork. "Benjamin uses *aura* – and aura is a kind of sacral dimension of the things – as a name for the topological inscription of an artwork into *here* and *now*. But that means that every installation re-creates an aura of originality precisely because it installs things – gives them topologically defined here and now. So installation can do something mysterious, quasi-religious, making an original out of a copy."[438] The media artworks in discussion blatantly stage the quasi-religious. Mise-en-scène, lighting, and sonic background enhance the 'sacred' character.

In this chapter, I have taken an examplary look at artists' positions in sci-art as well as science's role in this context. Many of the protagonists are hesitant or even strongly

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[433] Paul 2003, p. 13.

[434] Cf. James Elkins: "[T]he postmodern sublime has a history of functioning as a placeholder for the otherwise unacceptable discourse about religion.", in: Elkins/Morgan 2009, p. 165.

[435] See Paul 2003, p. 86.

[436] www.darksideofcell.info/about.html.

[437] "Installation art is interesting in this regard. It is not about individual objects, but the sacralization of a certain space. It is an interesting medium, because it has to do with the marking of a void space as an art space: everything that is inside the space automatically becomes art. […] Of course the antecedents of installation art are temples and churches, where lines are also drawn between sacred space and secular space. To a certain extent, one can say that installation art is the leading art of our time, and it is only conceivable as an outgrowth of those older traditions." Groys in: Elkins/Morgan 2009, p. 164.

[438] Ibid., p. 165.

disapprove of being classified by the booming label 'art and science'. On the one hand, rejecting art historical classification is a common strategy to keep the reigns of interpretative power in one's own hands. On the other hand, it has to be conceded that the label 'art and science' is a mere theoretical aid as is the case with any categorization. The individual artist as well as some of the artworks can also be viewed from a completely different angle and thereby reveal very distinct qualities. However, by looking at the niche phenomenon 'nanoart'[439] and at the artists involved, I deem it possible to shed light on players and networks in media art as well as try an in-depth analysis of the specificity of 'science' functioning at the same time as a label, as a cultural authority, and as a quasi-religious power.

The media art community is a small community. The same players meet at recurring places. Exhibitions on 'art in the age of nanotech' congregate the ever-same invitees. Networks are tightly knit, institutions are entangled through protagonists' actions. As almost all actors are affiliated with academe, international bondage is achieved via PhD programs or other cooperations. The strong tie is 'art and science' rather than 'nano' which at times serves as intersection point of the artists' sometimes quite divergent positions. The hype around nanotechnology in the media, the number of international research programs established in its name, and the omnipresence of the technosciences in the past decade have rendered 'nano' an attractive *sujet* to be discovered by artists. Funding for sci-art most often comes from the educational sector and exhibitions on nanoart have been examplary for artists' and curators' common interests. All of the artists have been involved in artistic environments other than 'nanoart' and all of them have been supported by various other sources. However, the point I want to argue here is that a glance at nanoart's mise-en-scène internationally is representative for 'art and science' in general.

Contrary to 'art and technology' (and especially in contrast to the tight entanglement of art, technology, and the industry in Ars Electronica's FutureLab, for example, or in Japanese creative industries, as discussed in the first chapter), 'art and science' reveals very different working mechanisms. While a lot of media art running under the label of

[439] Again, I have only focussed on interactive media art installations in this context, not on the myriad of other forms of images and art that are often subsumed under this umbrella term. In this context, cf. Nordmann's critical stance on kitsch and technoscience: Alfred Nordmann, "Kitsch – zur Kritik technowissenschaftlicher Weltgestaltung", in: Thomas Koebner ed., *Ästhetische Existenz – Ethische Existenz. Ein zeitgenössisches Entweder-Oder?* (Stuttgart: Edition text + kritik 2008), 72-83.

technology is able to attract *corporate* sponsoring,[440] the tag 'science' pulls in funding sources of academia and the wider education and research sector (e. g. science museums, or research foundations like VolkswagenStiftung). Media art benefits from science's radiance in the heyday of Big Science. The position that science adopts in a 'knowledge society' in which the scientific and the technological have assumed a dominant role is related to the "rhetorical foundation of the authority of scientific knowledge"[441]. With Thurs, I understand the field of 'art and science' as one manifestation of art's reflection *of* and benefit *from* science's cultural prestige. Science here can be regarded as a word, a body of knowledge, an authority, in any case as a discursive category.[442] While the label 'art as research' has allowed many an artist to occupy a position outside of market-based art,[443] many media artists – especially in the 'art and science' arena – have taken a similar path by working in a field that relies on funding from institutions segregated from the regular art market.[444] A good example of yet another branch of media art in this context is the so-called bioart, encompassing artists like Joe Davis, Eduardo Kac, the Critical Art Ensemble, or Natalie Jeremijenko. The outcome of these artistic endeavors is rarely marketable in a traditional sense. In Davis' DNA works, Jeremijenko's 'experimental design', or in the performance-oriented artworks by Kac, the tags 'life science' and 'bio' ennoble an artistic approach of science with oftentimes stunningly little constraint. The proclaimed role of the artist between society and science here is not unlike the one when the Experiments in Art and Technology were launched in the 1960s.[445] Whether or not the artist really does function as a critic, a visionary, a researcher, or a philosopher, bioart largely uses recurring tropes and rhetorics in which the 'scientific' unfolds its authority.[446] Bioartists and nanoartists avail themselves of this aura – in order to obtain both, financial support and prestige in media art and the academic sector.

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[440] The MIT Media Lab, almost 100% corporate-sponsored, is no exception in its adornment with the arts. Through the graduate program 'Media Arts and Sciences' and various research units it fosters the development of technology in "unorthodox" ways, evidently in close dependence on the industry.

[441] Thurs 2007, p. 4.

[442] Ibid., p. 2.

[443] Cf. Mader (forthcoming).

[444] Although of course funding from academia and foundations is not independent of the art market's mechanisms.

[445] See e. g. Eduardo Kac, *Telepresence & Bio Art. Networking Humans, Rabbits & Robots* (Ann Arbor 2005).

[446] I do not want to go into detail about bioart. There exists an abundant volume of literature on it, unfortunately all too often uncritical and not rarely naively repeating common empty phrases. For a brief survey see Wilson 2010; on Joe Davis, Eduardo Kac, or Critical Art Ensemble see Reichle 2009.

The aura surrounding 'science' relates to its reputed eternal validity. Max Weber's remarks on the 'disenchantment of the world' in his speech "Science as a Vocation" inextricably linked science to the question of trancendental *meaning*. An incessant glance into the future and the unbroken belief in progress is underlying the very conception of science. The technosciences do not form an exception in this discursive framework. On the contrary, the rhetorics beclouding them are nourrished by the same eloquent energy and unbroken optimism that have been driving 'science' as a universal research program *and* as a discursive category ever since modernity. A constant preoccupation with questions on future and progress also forms the foundation of 'art and science' since its very inception.

I want to come back to Alfred Nordmann's position which has been alluded to earlier. The philosopher and member of the interdisciplinary research group on nanotechnology at South Carolina University asserts that the technosciences have brought about a decisive change in experimental culture. According to his observations, the experiment in the age of technoscience is no longer an analysis oriented toward the future. Instead, Nordmann sees little more in nanotechnological experimentation than "a spectacle [… :] the technosciences enter the realm of theater and are searching for an intensity of experience which is only possible excluding any transcendental future".[447] He argues that the technoscientific experiment is merely a proof of elaborate technological skills and not a set up with unknown outcome anymore.[448] In this context, Nordmann asks about art's cognitive interest: "What kind of a knowledge can the arts produce in a present whose future consists mainly in technoscientific promises?"[449] He implicitly answers his own question, concluding with the technosciences' need of some kind of an "art criticism". "A critique of the technosciences as art criticism can be provided by the humanities, but most of all by the arts themselves and especially by the theater."[450]

It is debatable whether or not the status of the experiment is indeed altered in the 'age of the technosciences'; whether or not it is any longer oriented toward the future.

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[447] Nordmann 2009, p. 18.

[448] Alfred Nordmann, "Was wissen die Technowissenschaften?", in: Carl Friedrich Gethmann ed., *Lebenswelt und Wissenschaft.*, XXI. Deutscher Kongress für Philosophie, Deutsches Jahrbuch Philosophie, Vol. 2 (Hamburg: Meiner 2011), (*cited after publication manuscript),* no pag.

[449] Nordmann 2009, p. 8.

[450] Ibid., p. 21.

Noteworthy is how Nordmann calls on the arts of all things for a necessary relativization of the technoscientific promise and construction of "a brave new world"[451]. I do not see any of this realized in the nanoart discussed above. I am skeptical about 'art and science' as a whole reflecting or diffracting technoscientific promises and I am hesitant to concede the role to art usually ascribed to it in this context – i. e. that of a critic. In none of the media artworks I find a critical appraisal of nanotechnology; neither of its colorfully created atomic worlds, nor of the relation of its images to 'reality', nor even of its societal relevance. I see an art re-enchanting the world with scientific wonders, an art which indeed takes the place of a "parallel poetry".

Much more interesting than entering this all too often normative debate, however, appear to me the underlying ongoing rhetorical entanglements of the triad art, science, and technology with respect to 'the present' and 'the future'. It has become evident that art set in relation to science and technology has ever since been part of the overall discourse on the future and on progress. In the following chapter, I will analyze how the categories 'art' and 'science and technology' have undergone a discursive framing which has shown striking continuities and few ruptures from the avant-gardes until now.

[451] Nordmann 2011, no pag.

III Media Art and the Future

> "We enter a new era", Norman Bel Geddes, 1932
>
> "We are entering a new age here on Earth", directors' remark, Ars Electronica Festival 2009

"Are we ready for the changes that are coming?"[452] Norman Bel Geddes' question immediately following the above-quoted opening sentence in his seminal publication *Horizons* from 1932 spans a vector space for both, a vision of the future and a reflection of art's and design's role in it. More than seventy years later, after another world war, after reconstruction in Europe and Japan, the economic growth of the 1960's, after a 'digital revolution' and the turn of the millennium, Gerfried Stocker and Christine Schöpf, directors of 2009's edition of the Ars Electronica Festival, once again see a new age rising.[453]

Throughout the 20th century, we have been exposed to several 'new ages' beginning. It is the very characteristic of opening remarks, manifestos, future visions, of historiography itself to locate the present self in a timeline between past and future. The frequency with which these 'new eras' have been proclaimed is remarkable, also how the 20th century – and now the 21st – incessantly have seen the wheel being invented radically anew every other year. Much has changed since Bel Geddes' early 1930s. And yet appraisals of the respective present, in 1932, in 2009, read like a seemingly perpetual conclusion that something is dissolving, that something radically new is coming. That we have to position ourselves in an increasingly fast-moving, confusing, technologized future. The new horizon which Bel Geddes saw impending was about to "inspire the next phase in the evolution of the age".[454] As mentioned above, in the context of Ars Electronica Festival in 1992 Peter Weibel welcomes new technologies (endophysics and nanotechnology) causing "the grid of here and now [to] become more malleable", "free[ing] us from the fetters of reality".[455] The designer of the early 20th century and 60 years later the media theorist revel in novel possibilities.

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[452] Norman Bel Geddes, *Horizons* (Boston: Little, Brown & Co. 1932), p. 3.

[453] Gerfried Stocker, Christine Schöpf, "Human Nature", in: *Human Nature. Ars Electronica 2009*, exh. brochure (Linz 2009), p. 2.

[454] Bel Geddes 1932, p. 4.

[455] Weibel 1992, p. 11-12.

In 2009, Stocker and Schöpf introduce genetic engineering and biotechnology as the "truly indicative markers of this transition to a new epoch".[456] They ponder the "age definitely characterized by humankind's massive and irre-versible influences on our home planet".[457] For their foreword to Ars Electronica 2010 they strike a different note. Now, "[t]here's no time left for warnings. […] We've passed the point of no return. The dramatic consequences are looming on the horizon today".[458] However, they see some light for our gloomy future: "In search of new ways out of this mess, the Ars Electronica 2010 turns to the pioneers of our age, the artists, designers, engineers and scientists, who bring creativity and idealism to bear in their work on an alternative future."[459]

What these citations and the ensuing contexts have in common is their aim to position art and design in a present expectant of the future. The future is the 'horizon' already in sight. They oscillate between visions of progress and catastrophe. But one thing is inherent to all of them: they annunciate art as a main resort in a future of technology and change.

Media art, closely related to technological development, has evolved as an art form parallel to art using conventional media, with distinct theorists, institutions, and financial support. The first two chapters of this dissertation each encompassed a case study of media art in different settings – Device Art in Japan and nanoart mostly in the United States and in Europe. In these chapters I have illuminated certain aspects of the marriage of art and technological development and media art's flirt with science. Understanding both cases as subfields of cultural production, I was looking at players' position-takings, at ascriptions to objects, and at the funding context as being immensely relevant to positionings in the field.[460] It has been demonstrated how media

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[456] *Human Nature. Ars Electronica 2009*, exh. brochure (Linz 2009), p. 2.

[457] Ibid.

[458] Directors' remark by Gerfried Stocker and Christine Schöpf, in: *repair - Ready to Pull the Lifeline. Ars Electronica 2010*, exh. brochure (Linz 2010), p. 2. The rhetoric employed here is close to that of environmental activism of the 1970s, cf. e.g. Donella H. Meadows et al., eds., *The Limits to Growth* (New York: Universe Books 1972); cf. also Kai F. Hünemörder, "1972 – Epochenschwelle der Umweltgeschichte?", in: Franz-Josef Brüggemeier, Jens Ivo Engels, eds., *Natur- und Umweltschutz nach 1945. Konzepte, Konflikte, Kompetenzen* (Frankfurt Main and New York: Campus 2005), 124-144. I thank Verena Huber Nievergelt for this reference.

[459] Ibid.

[460] Cf. above chapter I, Bourdieu 1993, Glauser 2009.

art's dependence on specific funding bodies and the respective position of a player influence the rhetorical paths taken within the field.

I now want to depart from this micro view and historicize media art and its discursive lining. Rhetorics of artists, curators, and theorists in the fields of 'art and technology' and 'art and science' will now be regarded within a historical genesis. There is a remarkable discursive afterlife of modernity in today's media art.[461] The great disillusionments of the 20th century, its atrocities, and broken utopias, leading to a substantiated *Kulturkritik* seemed to have accorded a new place to art in society yet altered little in customary attributions to it and its discursive framing. Cultural criticism is an expression of a consciousness of time, of self-location in a present with respect to an imminent future. This is a central aspect also in the field of media art, and all the more so in the two terrains of artistic action on which I focus in my study. I therefore wish to set into perspective the relevance of narratives of past and future in its discourse, specifically in the media art discourse revolving around themes of science and technology. Art's relation to ideas of sublimation will be of fundamental importance in this discussion.

Unlike most of the contributions to the topic of art, technology, and science, I am not interested in ascribing normative functions to (media) art. Rather than taking an art-philosophical stance trying to seize art as an ontological given, also in this chapter I favor the art-sociological view describing art as located within a field or system. This allows me to critically approach the relativity of the term 'art' as it has already been brought to the fore in the discussion of the Japanese terms 'bijutsu' and 'geijutsu' in chapter one. An appraisal of the conception of art as a societal entity nurtures my discussion of art connected with technology and science, modernistic utopias, and religion's and spirituality's role in this context. This is what the two interludes in this chapter consecrated to 'ontologies' try to illuminate.

The dichotomy created by the confrontation of an example of media art in Japan with sci-art in 'the West' shall remain significant. With nanoart as an exemplification of an essentialist understanding of 'art' and Device Art as its opposite, the problematic status of the term 'art' will be set into perspective and rendered fertile for a further evaluation of the history and present (that is, historicization) of certain works of media art. In this macro view the dichotomy then disintegrates into a common bracket. Both

[461] Cf. Dieter Daniels, *Kunst als Sendung. Von der Telegrafie zum Internet* (Munich: C.H. Beck 2002), esp. p. 153 et seq.

cases serve as an extrapolation to shed light onto the construction of a 'counter-world' which is reflected in the media art discourse around the recent turn of the millennium – in many ways similar to a discourse around 1900 when contemporary artistic production was fashionably set in contrast to the "unbearable demands of modernity"[462] nurturing art's very status. Two cases, two specific media artistic contexts, both circulate around a changing present. The following chapter will illuminate how media art is constituted as and within a salvation narrative in a technologized age.

I am interested in the constitution of media art as a category of an 'art of the future'. By inserting the two above-discussed cases into the 'broader story' I will juggle with fractal narrations within a meta-narrative. In doing so I will not be able to avoid a confrontation with the problems of any attempted historicization.[463] My standpoint will inevitably be determined by my position as an art historian taking a glance at the field of media art. Within the many 'histories' I take up a place itself not independent of subjective choice, preferences, and evaluations. After all, this dissertation will be another attempt of shifting the weights.

Ontologies I: Science in Art – Religious Residues

> The art of the 21st century could take on the role of a mediator between human and posthuman consciousness, quite like it was used in bygone cultures to mediate between humans and gods.[464]

Throughout the course of the past century, through evaluations and re-evaluations in the field of aesthetics, art has never lost the classical ascription of being a mediator between the beholder and an extramundane opposite. Although there have been numerous attacks on art's autonomy and efforts to liberate it from the 'White Cube' and elitist affiliations, it is still endowed with abilities that constitute its uniqueness. Media art in its multiple varieties is furthered as a progressive artistic force of the

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[462] E.g. Georg Bollenbeck, *Eine Geschichte der Kulturkritik. Von Rousseau bis Günther Anders* (Munich: C. H. Beck 2007), p. 11; see also Charles Taylor, *The Malaise of Modernity* (Toronto: Anansi 1991).

[463] Cf. Geertz 1973; on the problem of the 'grand narrative' versus the 'small narrative' cf. Jean-François Lyotard, *The Postmodern Condition. A Report on Knowledge* (Manchester: Manchester University Press 2004).

[464] Ascott 1993, p. 351.

present and an art of the future.[465] Yet despite all groundedness in technology and science, there is an air of transcendence inherent to the object labeled 'art'. It is here that an omnipresent, most often unarticulated tension in the media art discourse finds its origin. Texts are diffused by rhetorics of legitimization,[466] as if there was a constant discomfort in the positions taken by artists and theorists alike. Much more than contemporary art using traditional materials, media art still struggles to be recognized as 'art' at all.

'Art and science' and 'art and technology' additionally combine the problem-afflicted abyss between *ars* and *techné* to which publications on the subject inflationarily like to refer. For a long time rather counter-world than rival to the scientific, art entered a new realm with the appearance of early art-sci phenomena. Confronted with long-existing hierarchies and value judgments, media art has not been able to rid itself of its difficult stand. The functional division between science/ technology and art dating back to the 18th century,[467] which also marked the emerging "rhetorical foundation of the authority of scientific knowledge",[468] is significant all the more for an art form dependent on just this authority. Media art and especially its varieties discussed here surge and break in constant confrontation with this gradation. The unease laid bare by surfacing rhetorics of legitimization and value judgments causing many art theorists to turn their back on media art in the first place are the undercurrent of a discourse which after all circles around ontological questions of 'art'.

In this chapter I want to shed light on the significance of this undercurrent. Lines of thought dangling like unwoven threads from chapter one and two, nanoart's flirt with the 'sublime', or the persistence of topoi of modernity within the media art discourse on the one hand and the indignation surfacing in reactions to commercializable art like Device Art on the other hand converge in one focal point. Whether a utilitarian approach or an enchanted installation piece, the artworks under scrutiny revolve around recurring tropes connected to the sublimation of 'experience' (see chapter *Ontologies II*). In the following I deem it valuable to elaborate on these terms and ideas in order to debate the foundations of common defense mechanisms in the media

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[465] Cf. Daniels 2011. For the general context of media art institutions, Daniels draws attention to the fact that they are increasingly exposed to the difficulty of justifying their single status due to the media technologies becoming rapidly antiquated.

[466] Cf. Lovink 2005; for the field of artistic research Borgdorff 2009, Mader (forthcoming).

[467] Bredekamp 1993, p. 77: "Der Motor dieser Entwicklung lag im Aufstieg des Nutzdenkens."

[468] Thurs 2007, p. 4.

art discourse. In doing so I am hoping to illustrate ideological webs and their dominance in the field. At the same time, on the basis of the two case studies on art and technology and sci-art phenomena, I also want to reflect about media art in terms of what Jean-François Lyotard has called 'postmodern knowledge'.[469] In the following subchapter, I will deliberately open a methodologically problematic gap between cultural criticism and art's location in the theory discourse of the early 20th century and media art practice and discourse around the year 2000. I shall do so in order to exemplify art's ascribed role in evaluations of a present perceived as rapidly changing and in visions of future and progress. All this calls for a critical discussion of any historiographical use and construction of narratives, of categorizations of the present with respect to the past, of evaluating periods of time or 'epochs'. I shall later attempt to formulate a summarizing statement on the coincidence of media art's emergence and what Lyotard observes as the decline of the "grand narrative" and the re-emergence of liberal capitalism (with its consumer culture) since the 1960s.[470] First though, I wish to come back to the striking relevance of spirituality in not only nanoart, but remarkably many other sci-art works. This will serve to critically confront art's ontological status in art theory and its relevance for the point of view taken by this study.

The art historian James Elkins has recently confronted the notion of the 'sublime' in his essay *Against the Sublime*.[471] Elkins argues that the sublime should above all be treated as a historic category with its heyday around Kant's work in the 18th century and major importance in romanticism in the 19th century, only to resurface in 20th-century theory in such a diffuse and incoherent manner that he suggests to refrain from using the term altogether and rather look for alternative notions and paraphrases. Valuable, however, for my analysis is Elkins' emphasis on the twofold character of the discourse on the 'sublime' and his thoughts on religious camouflage in the term. Following Peter de Bolla's argumentation in *The Discourse of the Sublime*, Elkins makes a point of separating the discourse *on* the sublime and the discourse *of* the sublime. While the former analyzes "forms, causes, and effects of the sublime", the

[469] Jean-François Lyotard, *The Postmodern Condition. A Report on Knowledge* (Manchester: Manchester University Press 2004).

[470] Ibid., p. 37 et seq. Lyotard's analysis of 1979 will become especially important in the epilog later.

[471] James Elkins, "Gegen das Erhabene", in: Roald Hoffmann, Iain B. Whyte, eds., *Das Erhabene in Wissenschaft und Kunst. Über Vernunft und Einbildungskraft* (Berlin: Suhrkamp 2010), 97-113.

latter produces sublime effects itself in conjuring up the sublime.[472] By retracing the persistence – and reappearance – of the sublime (or rather, of what might be labeled 'sublime' in this context) in many 'art and science' works, I want to illustrate striking interdependences of ideas originating in the 'transcendental'. As a contribution to the discourse about the sublime, it will now serve as a heuristic category in order to substantiate what has already been briefly suggested above.

A prominent example of the sublime in aesthetic theory after 1945 and of scientific notions sneaking into its language where they intermingle with the transcendental is Theodor W. Adorno's *Aesthetic Theory*. De Bolla's observations on a discourse *of* the sublime are parallel to Gerhard Richter's thesis that Adorno has striven for the very aestheticization of his *Aesthetic Theory* while apparently meditating on the aesthetic as such.[473] Notions of transcendence pervade Adorno's seminal *Theory*. The philosopher muses upon nature's beauty resulting from the metaphysical surplus between 'truth' and 'appearance' – a surplus of which art avails itself. "Artworks become [what they are] through the production of the surplus; they produce their own transcendence […]."[474] 'Transcending itself' is for Adorno the operating force of the artwork.[475] By transcendence he understands something close to Benjamin's 'auratic', an 'atmosphere', an appearance pointing beyond itself.[476]

While these epiphanic conceptions originate in religious terminology, their usage is inherent to art theory elaborating on art's essence (an essence of which Adorno would say that it is "not expressible in any meaning language"[477]).[478] In critical recourse to Kant's sublime, Adorno's theory is marked by an indebtedness to normative judgment in spite of conceding the artistic character's affinity to the social and the historical.[479]

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[472] Ibid., p. 103.

[473] Richter 2006, p. 119.

[474] Adorno 1973, p. 122 [my transl., also in the following].

[475] "Kunst sinkt unter ihren Begriff herab, wo sie jene Transzendenz nicht erlangt, wird entkunstet.", ibid.

[476] Ibid., p. 123, cf. also p. 73.

[477] Ibid., p. 96.

[478] Concerning early Christian art, Hans Belting has elaborated on the very "exchange of the aura of the sacred for the aura of the artistic" in his 'History of the image before the age of art', Hans Belting, *Bild und Kult. Eine Geschichte des Bildes vor dem Zeitalter der Kunst* (Munich: C.H. Beck 2004), p. 538.

[479] Ibid., esp. p. 154, 272, 335. Kant's notion of the sublime has an evident closeness to contemporary religious discourses and is significantly characterized by infinity, the 'absolute whole'. Cf. Ernst Müller, "Religion und Ästhetik", in: Birgit Weyel, Wilhelm Gräb, eds., *Religion in der Lebenswelt. Erscheinungsformen und Reflexionsperspektiven* (Göttingen: Vandenhoeck & Ruprecht 2006), 256-276, p. 266.

Normative judgment of what is true, good, artful (vs. "entkunstet") art is deposited in describing the artwork as a "thing among things" becoming "something Other than thing". It is inhabited by a Hegelian *Geist*. "*Geist* in artworks transcends their thing-ness as well as the sensual phenomenon, but only insofar as those are moments. […] *Geist* is their ether, that which speaks through them."[480] Ether, a medium of 19th-century scientific theory whose terminological origins lie in the religious, occupies a denotative place in Adorno's thought. Further down in his *Aesthetic Theory*, art is characterized by unfolding an illusionary 'enchantment' within – what the philosopher labels – a "dialectical ether"[481].

The passage is illustrative of how Adorno's attempt to grasp art's givens and how his clear-sighted analysis of its vicarious empowerment is composed in a language infused by a polysemous terminology. In lieu of alternative phrasing, Adorno meditates on ontological questions, on the artistic sublime, and its enchanting qualities in terms of past scientific theory beholden to highly connotative concepts. In interconnection, religious and scientific ideas here find their way into art theory, while the scientific language is impregnated with the quasi-religious imagination of a 'reality beyond'. While Adorno's influential ideas are now half a century old, the sublime lingers on in postmodernity and so does the auratic. For Elkins the sublime (and related terms like the 'transcendental' or 'presence') is a concept allowing to let religious "truths" slip into a presumably secular language of contemporary art theory.[482]

Accordingly, religious residues re-surface in 'art and science'. As has been shown above, nanoart approaches the space which ether theory filled in the 19th century. Interactive installations deal with invisible worlds beyond our reach by conjuring up technoscientific insights in the gallery space.[483] While science's aura was once claimed from the gods, rendering it a placeholder for religion, esotericism and facets of modern

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[480] Ibid., p. 135.

[481] "Kunst wird davon bewegt, daß ihr Zauber, Rudiment der magischen Phase, als unmittelbare sinnliche Gegenwart von der Entzauberung der Welt wiederlegt ist, während jenes Moment nicht ausradiert werden kann. [...] Der Zauber selbst, emanizipiert von seinem Anspruch, wirklich zu sein, ist ein Stück Aufklärung: sein Schein entzaubert die entzauberte Welt. Das ist der dialektische Äther, in dem Kunst heute sich zuträgt. [...] In der entzauberten Welt ist, ohne daß sie es sich eingestünde, das Faktum Kunst ein Skandalon, Nachbild des Zaubers, den sie nicht duldet.", Adorno 1973, p. 93.

[482] Elkins 2010, p. 109.

[483] Cf. Benson 1984 on the proximity of ether theory to concepts of the sublime and an "identification of infinite space with God", p. 827.

spirituality inform a "sense and taste for the infinite"[484] flashing up in 21st-century artworks that stage the ungraspable.[485] The *theologici electrici* of the 18th century explained their world by the "meta-magnet God",[486] Hendrik A. Lorentz and Henri Poincaré envisaged an ether filling the void as an "embodiment of absolute space".[487] On envisioning non-intelligible realms, not only 19th-century science, but also sci-art turns to the numinous. Through their mises-en-scène, the dim lighting of the installation space, their reference to hidden realms, many media art works aim at enchanted experience rather than displaying a present and future of antiseptic disenchantment. Early science tried to explicate the invisible by the aid of higher entities not yet annihilated by disenchantment. Artworks tackling science today revert to a similar if at times less explicit insinuation of an *au-delà* – a gesture appearing to be an anthropological constant when turning to an imagined reality beyond human comprehension. Here surfaces what Bruno Latour calls the "crossed-out God" of Modernity.[488] It is also a new edition of ether's ubiquity which Dieter Daniels has described in the context of early radio experiments and more recent media art.[489]

Boris Groys has debated the "sacralization of a certain space" in installation art drawing on the Benjaminian aura: "[…T]hat means that every installation re-creates an aura of originality precisely because it installs things – gives them topologically defined here and now. So installation can do something mysterious, quasi-religious, making an original out of a copy."[490] The auratic and the postmodern sublime "are

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[484] German theologist and philosopher Friedrich Schleiermacher on religion.

[485] On early science, enlightenment, and occultism cf. Bredekamp 1993, p. 50; on entanglements of early science and theology: Siegfried Zielinski, "Theologici electrici. Einige Passagen", in: Bernd Witte and Mauro Ponzi, eds., *Theologie und Politik. Walter Benjamin und ein Paradigma der Moderne* (Berlin 2005), 254-267.

[486] Zielinski, ibid., p. 258.

[487] Tian Yu Cao, *Conceptual Developments of 20th Century Field Theories* (Cambridge: Cambridge University Press 1998), p. 53. The list could be continued for the 20th century and more recent scientific ideas e. g. by Alan Turing and the "programming god": cf. Bredekamp 1993, p. 100.

The sociologist Simmel has described the aesthetic and the religious with respect to their relation to 'reality'. It is a distance far from immediate reality into which the religious as well as the aesthetic 'attitude' set their object, only to bring us closer than ever possible to it: discussed by Volkhard Krech, "Kunst und Religion", in: Weyel/Gräb 2006, 101-117, p. 108-109. On this division and art's connection to 'reality' see also Niklas Luhmann, *Die Kunst der Gesellschaft* (Frankfurt Main: Suhrkamp 1997), p. 229.

[488] Bruno Latour, *We Have Never Been Modern* (Cambridge, MA: Harvard University Press 1993), p. 33. Latour's deliberations on this specificity of 'modern' thought will again become relevant later on in this chapter.

[489] Cf. Daniels 2002, esp. p. 265.

[490] Groys in: Elkins/Morgan 2009, p. 165.

good examples of concepts that function […] as camouflaged religious terms"[491] and they re-surface in media art and its theoretical corpus. They appear even more ostensibly in an art displaying an explanatory void left by science orbiting imagined worlds. From Kac' *Genesis* to *Nano-Scape* by Sommerer and Mignonneau, or Takuro Osaka's *Revelation by Cosmic Rays*, sci-art works are furnished with quasi-religious momentum.

The transgenic artwork *Genesis* is based on the biblical sentence "Let man have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moves upon the earth." (Gen. 1:26). The sentence was converted into Morse code and subsequently into DNA base pairs. The transgenic bacteria into which the gene was incorporated were then exposed to UV light in the gallery space – a process altering their DNA sequence. The newly emerging sequence was finally transcribed back into base pairs, Morse code, and letters, changing the original biblical sentence in what the artist calls a "symbolic gesture".[492]

Osaka's *Cosmic Rays* series emerged from the artist's collaborative research with the Japan Aerospace Exploration Agency (JAXA) detecting energy-particles emitted by outer space. Speaking about the installation, Osaka relates to "our sense of the existence of space and an intuition that our own existence has meaning and purpose, as manifested in the work".[493] Naturally, the inherent beauty of Osaka's work is nurtured by the visitor's imagination of numinous outer space reaching into the gallery in the form of 256 red LEDs. The artwork may set free similar associations as those intended by artists Sommerer and Mignonneau when they seek to offer an experience of the nanoworld in presumable 'interaction' with invisible self-organizing 'atoms' in their work *Nano-Scape*. Like in Vesna's and Gimzewski's interactive installations or *The Dark Side of the Cell* by Pelling and Niemetz, scientific findings and spiritual aspects blend in the artworks' properties.

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[491] James Elkins in Elkins/Morgan 2009, p. 165.

[492] Cf. Kac 2005, p. 249-263. We are, however, informed that the artist does not own a bible. By his artwork he wants to state "that we do not accept [the sentence's] meaning in the form we inherited it and that new meanings emerge as we seek to change it.", ibid., p. 253. Also another work by Kac contains biblical references: the transgenic work *The Eighth Day* (2001), adding one day to the Judeo-Christian creational myth in its title. The installation again involves genetically manipulated animals. See Sheilah Britton, Dan Collins, eds., *The Eighth Day. The Transgenic Art of Eduardo Kac* (Tempe AZ: Arizona State University 2003).

[493] Wilson 2010, p. 105. See also Uwe Rüth on Osaka's works: "They show what links all philosophies, all world religions – whether in the North, the West, South or East: the glance into a world that becomes and stays a miracle – for the believer as well as for the atheist.", exh. brochure, Pola Museum of Art, Hakone, Kanagawa, Japan, November 2005, n. p..

Religious residues in art theory and art span from Adorno's *Aesthetic Theory* up to works of media art.[494] When sci-art alludes to the sublime in manifold ways, it is again the distance from in contrast to closeness to 'reality' that marks the auratic.[495] Technological means and the expression of an artistic surplus merge in the artwork. While Elkins emphatically denies any operational *usefulness* of the 'postmodern sublime', that is, for a use in art theory focusing on contemporary art, his remark about the *concept* and its "crypto-religious contexts"[496] helps to highlight and explain the presence of spirituality in media art works today, especially in many works relating to science and the exploration of unknown possibilities. Art's pseudo-sacred qualities here are reflections of science serving as an *ersatz* religion throughout modernity.

Writing History – On Progress and Futures

Spaces of Open Possibilities – Visions of Art & Technology

The disenchantment of the world through science and rationalization on the one hand (chapter two) and the enhancement of every-day life with playful technological items on the other hand (chapter two) both pivot around the same question – the question of how scientific and technological developments are inserted into narratives of the present, the future, and progress. In modernity,[497] future is a space of open possibilities, as Hans Ulrich Gumbrecht summarizes on the basis of Reinhart Koselleck's seminal studies. "Now [with historism] one perceived humanity […] as incessantly leaving behind the pasts as 'spaces of experience' in time and moving into ever new futures consisting of open 'horizons of possibilities'. Between these futures and those pasts the present seemed like a 'mere moment of transition' and the thus-experienced present became the historical habitat of the Cartesian subject merely centered around functions of consciousness. Its role was to select ever new projects out of the

[494] Central in this context already, first published in 1912: Wassily Kandinsky, *Ueber das Geistige in der Kunst* (Bern: Benteli 1973); for a short discussion of residues of the religious in modern art: Mircea Eliade, "The Sacred and the Modern Artist", in: Diane Apostolos-Cappadona ed., *Art, Creativity, and the Sacred. An Anthology in Religion and Art* (New York: Continuum 1998), 179-183.

[495] Cf. Walter Benjamin's understanding of the term 'aura' as the "unique appearance of a distance, however close it may be." Benjamin's conception of the aura describes phenomena of nature as well of the traditional artwork. Walter Benjamin, *Das Kunstwerk im Zeitalter seiner technischen Reproduzierbarkeit* (Frankfurt Main: Suhrkamp 1977), p. 15.

[496] Elkins 2010, p. 110.

[497] Cf. the Introduction on the terms 'modernity' and 'postmodernity'. Gumbrecht, following Koselleck's studies, talks about the age of 'historism', especially since the early 19th century.

possibilities offered by the future for a transformed world, adapting experiences from the past to the different conditions of the present and the future."[498] This traditional image of the future was then changed radically by the collapse of the "chronotope of progress" in the 20th century: "For in the early 21st century, future presents itself no longer as a horizon of possibilities open for action. Rather, future is again moving toward us – someone familiar with the middle ages knows of such concepts – with impending, in detail unassessable scenarios, be it global warming, nuclear catastrophe, or the potential consequences of a demographic imbalance."[499] Hence the belief in 'progress' is essentially questioned, the conception of which was inextricably linked to emerging technology and according to which the future would always be better than the present.[500]

Alfred Nordmann speaks of a completely different prospect, in his discussion of technoscience and related conceptions of the future. He reflects upon images of present and future in the context of technoscientific experimentation as a search for 'knowledge' and 'truth'. He locates technoscience with its experiments as well as the question of art's cognitive interest in this reference field of present and future. Contrary to Gumbrecht's evaluation, for the 'age of technoscience' Nordmann spots a lingering belief in progress as in times of Charles S. Peirce or Max Weber.[501] He describes our perception of the future still as a "space of possible experiences"[502]. "The future belongs to old and new technologies that simultaneously create our problems and promise their solutions."[503] The forecasts of technoscientists are thus ahistorical, presenting "the future as an empty shell" and completely open.[504]

Does Nordmann's analysis really stand contrary to the image of history and future postulated by Gumbrecht as the 20th-century chronotope? Or is it rather *one* among several possible conceptions, prevailing specifically in the scientific context? Nordmann ends his reflection praising the arts as a critical instance, as something capable of confronting technoscientific promises by examining notions of

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[498] Hans Ulrich Gumbrecht, "Stagnation", *Merkur* 62 (Sept/Oct 2008), No. 9/10, 876-885, p. 879.

[499] Ibid.

[500] Cf. Reinhart Koselleck, *Vergangene Zukunft. Zur Semantik geschichtlicher Zeiten* (Frankfurt Main: Suhrkamp 1989), p. 363-365.

[501] Nordmann 2009, p. 9-11.

[502] Ibid., p. 10.

[503] Ibid., p. 9.

[504] Ibid., p. 16.

'experience'.[505] Nordmann's position is not uncommon in the art discourse. Rhetorics of allegedly 'naïve' scientists are opposed by alternative scenarios of the future, projections and predictions, and the arts' role in them. What exactly then is sci-art's master narrative of the future?

When media artist Maywa Denki, also known as Nobumichi Tosa, launches his *Tsukuba Series* of musical instruments and gadgets, he ironically refers to Japan's "future city"[506] and to years of Japan's utopian visions for the future. The economic boom due to highly successful technological advancement led to the planning and construction of Tsukuba – in terms of city planning the island's post-war Wolfsburg coming close to being an "ahistorical nonplace" to say it with Arata Isozaki[507]. Tsukuba, a symbol of Japan's (post)modernism of the postwar era and of technology's relevance to the country's rise in international reputation, was the manifestation of a space of possibilities, of a new belief in the future of a country deeply upset by World War II and its aftermath. The *Tsukuba Series*' title is an indicator of how significant postwar history and historiography still is for present media art. A humorous hint at hopes of grandeur and well-being slides into a Device Art aimed at entertainment and amusement. It strikingly seems to accord with media art pioneer Fujihata's above-mentioned remarks on Japan's industry of consumer products: While after World War II the United States strongly invested in computer development via their military budget, in Japan – with no funding for the military sector – it was the importance and promotion of consumer products that became a driving force for her economy.[508] These developments accounted for the rise of Japan to being the second largest national economy worldwide. Science's triumphs and their application in technology were seen as the foundation of this ascent. The *Tsukuba Series* of instruments for "machine music" ironically testifies to techno-visions of Japan's era of newly-gained

[505] Ibid., p. 21-22.

[506] Isozaki 2006, p. 74.

[507] Ibid., p. 77. Architect Isozaki points out how the planning of Tsukuba Center Building with its plaza was an idea "Western in origin through and through, and quite fictional in the immediate cultural context at Tsukuba.", p. 74.

[508] Cf. Mercedes Bunz on how consumer culture has eclipsed the Kittleresque conception of the military's avant-garde role in technological development: Mercedes Bunz, "Das Mensch-Maschine-Verhältnis. Medientheorie mit Kraftwerk, Underground Resistance und Missy Elliott", in: Jochen Bonz ed., *Sound-Signaturen* (Frankfurt Main: Suhrkamp 2001), 272-290.

confidence. At a second glance it deals with the afterlife of a modern belief in a future meliorated by science and technology.

Japan's omnipresence at international venues showing newest research in art and design has already been mentioned. Be it at ISEA or Ars Electronica Festival, Japanese artists, engineers, and curators have achieved significant visibility. 2009's Ars Electronica festival was centered around "Human Nature" and 'epoch-making' changes by "achievements of genetic engineering and biotechnology"[509]. The newly opened Ars Electronica Center, a "Museum of the Future" according to the center's website,[510] exhibited most diverse research positions from biology and genetic engineering to robotism and brain research. An attraction on the main floor was Hiroshi Ishiguro's *Geminoid HI1* constituting the hub of the so-called RoboLab.

In 2010 robotism assumed yet greater attention at the festival. "Meet ASIMO in Deep Space" was an event completely booked out throughout the entire festival. Visitors had the chance to witness Honda's trophy robot ASIMO, presented by a blond hostess, perform on stage. Ars Electronica's liaison with cutting-edge robotic research did not come without the expense of drumming for the multinational corporation by showing promotional videos produced by Honda in a separate projection room. Rhetorics of a better future contrasted with this year's festival scheme of a world at a "point of no return". "See how robots in development now can bring out the best in us in the future"[511] – the company's teleology in turn starkly countered professor Noel Sharkey's talk on robotic use for military purposes during the festival's conference on "Human-Robot Harmony". Honda did not stand alone. Sharkey's critical remarks were followed by 'futurist' Alan Shapiro's emphatic paper on the importance of a friendship between humans and androids in times to come.[512] Next door in the "Future Factory" in Linz, engineer Ishiguro demonstrated a new outcome of his R&D lab at Osaka University. His *Telenoid*, an anthropomorphic robot puppet, was designed to be used in telecommunication in order to personalize technologized communication.

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[509] Directors' remark: *Human Nature. Ars Electronica 2009*, exh. brochure (Linz 2009), p. 2.

[510] www.aec.at/center_about_en.php.

[511] asimo.honda.com/.

[512] Parallel to a presumed greater acceptance of robots by the Japanese which I discussed in the first chapter in the context of 'nihonjinron' (rhetorics of Japaneseness), Shapiro, citing Ruth Benedict, stresses parallels between a certain flexibility of androids and Japanese life and culture: "The ability to live in the present and instantly readjust.", Alan Shapiro, "Toward a Unified Existential Science of Humans and Androids", paper given at Ars Electronica Festival, Linz, September 4, 2010 (published online: www.alan-shapiro.com/category/future-design/robotism/).

Also the Japan Media Arts Festival was present at Ars Electronica 2010, this year promoting robot animation through the most popular fictional figure of *Gundam*. A chronology on the development of robot animation pointed out the genre's importance for the postwar era:

> [In the 1960s…] it was generally believed that science and technology were all-powerful and could bring about prosperity and happiness. The humanoid robots depicted in animations tended to crystallize that entire mood. […] Early robot animations created a new mythology for the age of science.[513]

For the 2000s, progress had supposedly caught up with the future:

> Robot animation, which emerged as a symbol of the hopes and fantasies about the 21st century future, has now expanded far beyond the frame of the film, and is in the process of becoming reintegrated with reality.[514]

Media artist Maywa Denki's creations were then mentioned side by side with Sony's *Aibo* robot, Ishiguro's *Geminoid HI-1*, and Honda's ASIMO.

A vision of the future as a darkened horizon of impending catastrophes, as described by Gumbrecht, is used by Ars Electronica's organizers as the backdrop for staging art and more notedly design and technology as the savior for times to come. In inflationary presence, not for the first time the noun and adjective 'future' binds together techno-visions and media art. This art seems to sing of hope. After all, we encounter an unbroken belief in progress – progress here being "at the same time a category of objective occurrence and of subjective action", as Koselleck outlines.[515] Norman Bel Geddes' pragmatic call for the designer's embrace of the challenges presented by industrialization is mirrored by media art 80 years later. The designer, not afraid of rapid change and mass production around 1930, observed the "new era" with entrepreneurial spirit offering a significant place for art and design. While he took a stand against the prevailing reluctance of putting art in service of industrial design ("Art will be achieved by the machine – inspirationally and technically."[516]), his outlook upon and advocacy of such an art back then was in alignment with the

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[513] ROBOT-ISM, chronology on display at Ars Eletronica Festival 2010, in a section curated by Japan Media Arts Festival.

[514] Ibid.

[515] "Der Fortschritt war seit der Wortprägung immer zugleich objektive Geschehens- und subjektive Handlungskategorie." Reinhart Koselleck, "Fortschritt", in: Otto Brunner, Werner Conze, Reinhart Koselleck, eds., *Geschichtliche Grundbegriffe. Historisches Lexikon zur politisch-sozialen Sprache in Deutschland*, Bd. 2 (Stuttgart: Klett 1975), 351-423, p. 411.

[516] Bel Geddes 1932, p. 292.

tradition of contemporary movements fostering the merging of arts and crafts. It was neither terrified of technical developments, nor did it exclude the possibility, even the necessity, of integrating new materials into artistic practice.[517]

Science's mandatory belief in a development toward the better is necessarily shared by an art form reliant on technology. The juxtaposition of a changing present with art's role for present and future is a rhetorical trope from a time commonly labeled 'modernity'.[518] But more striking than seeing similar ideas at work in 21st-century electronic art is the fact that media art still seems to struggle with ideas now around for over a century.

Modernity's Counter-Worlds

It seems as if hardly any major source of the decades around the turn of the 20th century abstained from mentioning 'art' in the context of a present perceived as changing at a breathtaking pace. The experience of loss, the loss of meaning, of *Geist*, in an every-day life exposed to the cruelties of disenchantment, led to the recurring invocation of terms like "real experience", "naturalness", "immediacy", the "individual", the "dynamic" against the backdrop of the "mechanic" and the "rationalistic".[519] Already the romanticists had contrasted dull every-day life with a sublimated art. Around 1900, in a beginning age of distraction and entertainment, fears now were about that contemporary vices would end in the destruction of a 'culture'

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[517] Interesting is Bel Geddes' juxtaposition of art and design in his reasoning for progressiveness. In a conventional manner known from Le Corbusier's *Vers Une Architecture*, published in 1923, he does not abstain from drawing on icons of past architecture and art – the temples of Luxor and Athens, Michelangelo, Corot, and Cézanne – in order to highlight the eternal role of the artist. Early on in his exposé though he gives up 'art' as a term of reference only to return to it on the final pages presenting his outlook: "As between industry and the artist, their common interests will be further consolidated." (ibid., p. 292.) Bel Geddes expands the boundaries of 'art' in a way that would have horrified many of his contemporaries. His way of relating art to an industrial design of the future surpasses conceptions of a sublimated artistic sphere. It clearly is a reflection of the Arts and Crafts and similar movements' legacy, presenting us a crystallization of what is then thinkable in terms of a utilitarian application of 'art'.

[518] See exemplarily for a contemporary discussion on art and progress after Adorno: Juliane Rebentisch, "Fortschritt nach seinem Ende. Adorno und die Kunst der Postmoderne", in: Christoph Menke, Juliane Rebentisch, eds., *Kunst. Fortschritt. Geschichte* (Berlin: Kadmos 2006), 229-241. Although in critical response to Adorno, Rebentisch does see a meta-progress of art manifested today against the background of the "modernistic emphasis of the technical", p. 240. See also Daniels 2002.

[519] Bollenbeck 2007, p. 206.

held up by the educated class.[520] Within this conception of culture art is the sheet anchor of a degenerating present.

Sociologists of the time mused upon art's importance in this epoch of 'change'. For the sociologist Georg Simmel art represented a redemptory power in current times in "need of a counter-world". Art's autonomous "partial world" was where the individual could escape the feeling of estrangement.[521] Max Weber – however modestly – joined the voices of cultural criticism when he described the effects of rationalization and "mechanical petrification".[522] He equally observed the wish of 1917's youth for a "redemption of the intellectualism of science in order to return to one's own nature and thereby to nature as such". 'Real' art, among "the highest and most sublime values" in a painfully perceived disenchanted world, now had to be "intimate" and withdrawn.[523]

As an opponent position to the criticism of progress of their time and to the conjuration of art as a 'counter-world' to the machine age, the futurists rhetorically set out for new grounds. With youthful wrath Filippo Tommaso Marinetti had composed his Futurist Manifesto in 1909. Marinetti, speaking in a suggestive 'we'-form, announced a new artistic spirit running parallel to the contemporary appearance of "terrified locomotives", "enormous double-decker trams", "starving automobiles", a time of "energy and recklessness", "feverish sleeplessness".[524] The manifesto praises the "beauty of speed" and rebels against traditional values in favor of an art that "can only be violence, cruelty, injustice".[525] It is not a negative appraisal of changes in the metropolis, but an emphatic and aggressive celebration of a new age, full of optimism of progress and technology. The role of futurist art is to accompany revolutionary, at first still anarchist ideals as a motor of change toward a better future. Art is conceived as an instrument coping with change, as something progressively running in accordance with the 'unbearable' demands of modernity.

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[520] Ibid., p. 213-215. Bollenbeck describes Walther Rathenau's cultural criticism of 1918 as the anticipation of what later would be criticized by Adorno and Horkheimer.

[521] Ibid., p. 257. Simmel speaks of art as a "completely separate cosmos", as something "self-contained", "complete in itself, in need of no relation to the outside", Georg Simmel, *Zur Philosophie der Kunst. Philosophische und kunstphilosophische Aufsätze* (Potsdam: Kiepenheuer 1922), p. 40 and 46.

[522] Max Weber, *Die protestantische Ethik und der Geist des Kapitalismus* (Munich: C.H. Beck 2004), p. 201.

[523] Ibid., p. 612.

[524] Futurist manifesto: F[ilippo] T[ommaso] Marinetti, "Le Futurisme", *Le Figaro*, February 20, 1909, p.1.

[525] Ibid. It is well known that Marinetti and many fellow futurists left their anarchist roots and later heavily leaned toward fascism.

Twenty-five years and a world war later, now John Dewey declares to break with the post-romanticist idea still at work, which perceives art as being something remote and separate. He postulates the sublimation of every-day life through "esthetic experience". In the credulous tone of his time, the philosopher and educational reformer ascribes a "liberating and uniting power" to art which is perceived as essential in the pursuit of ideals such as truth, community, and a closeness to nature.[526] Just as the afore-mentioned positions, Dewey's *Art as Experience* is a reflection on art in times of ongoing modern change. His promotion of integrating aesthetic experience into every-day life still accords to art its singular role. Art "intensifies and amplifies" experience, it leads to a "new experience of life".[527] Also Dewey develops his thinking against the background of the "scientific statement and its present prestige".

> […T]he question of the place and role of art in contemporary civilization demands notice of its relations to science and to the social consequences of machine industry. The isolation of art that now exists is not to be viewed as an isolated phenomenon. It is one manifestation of the incoherence of our civilization produced by new forces, so new that the attitudes belonging to them and the consequences issuing from them have not been incorporated and digested into integral elements of experience.[528]

Only art is capable of "reorganizing our heritage from the past and the insights of present knowledge into a coherent and integrated imaginative union".[529] Art is the alternative draft to an epoch affording "more repulsion than at any previous time" and plays a significant role even in ameliorating the social disposition of the working class.[530]

The different positions exemplify two classical ascriptions to art. Art's quasi-sacred remoteness on the one hand and its alignment with progress on the other hand can, but do not necessarily, exclude each other. As there is a long critical history of 'progress' in art,[531] most positions calling for art's active social involvement in a progression toward the future, however, still hold up the idea of its autonomous status – the early futurists with their provocative stagings and their paintings heavily leaning toward

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[526] Dewey 1934, p. 349.

[527] Ibid., p. 103 and 104.

[528] Ibid., p. 337.

[529] Ibid., p. 338. Art thus becomes a way to overcome the gap between the 'two cultures' as manifested later in C. P. Snow's talk in 1959.

[530] Ibid., p. 343.

[531] Cf. Ernst H. Gombrich, *The ideas of progress and their impact on art* (New York: Cooper Union School of Art and Architecture 1971); also Rebentisch 2006.

Cubism, the US-American reformer John Dewey with his eulogy of art as "the only media of complete and unhindered communication between man and man"[532].

While the effects of industrialization had already been felt for a century when Dewey and Bel Geddes publish their visions of the future, still the impression prevails of an ongoing acceleration due to the developments around the turn of the century. 'Progress' has long become a buzzword broken into people's every-day lives in form of technical achievements.[533] With recent developments since the 1960s and – more specifically – with the *perception* of these developments as bearers of tremendous change often delineated by terms like 'globalization' and later 'Digital Revolution', the turn of the millennium in no way has come short of similar analyses of the present.[534]

The way in which research in robotism is presented at Ars Electronica festival testifies not only to the protagonists' future visions of an applied science but also to their location within a discourse. In accordance with Bollenbeck, by discourse I mean "a thematically coherent amount of text, the effects of a repertoire whose regularities develop behind the back of a speaker, linguistic practices that show interpretive models, processes of self-comprehension, and practices of ascription."[535] Media art and its products are integrated into a set of sanctioned expressions. It points toward the 'future' – toward something opening up a span of innumerable connotations and possibilities. This assessment surely is not congruent with what Gumbrecht characterizes as the mainstream assessment of a 'future' in a "post-historicist chrono-tope".[536] Japanese Device Art for example is describes as an art form between our technicized present and an even better future:

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[532] Dewey 1934, p. 105.

[533] For a discussion of Walter Benjamin's analysis of the artwork in the age of reproduction and his omission of the fact that "[t]echnological progress and romantic sensibility (*Empfindsamkeit*) are just the two sides of the same coin" cf. Beat Wyss, *Nach den großen Erzählungen* (Frankfurt Main: Suhrkamp 2009), p. 169-181, esp. p. 175-177.

[534] Hartmut Rosa accordingly observes a new surge of acceleration in Western developed societies taking place in the past decades and ascertains a decisive impact on their collective self-conception: *Beschleunigung. Die Veränderung der Zeitstrukturen in der Moderne* (Frankfurt Main: Suhrkamp 2005), p. 335.

[535] Bollenbeck 2007, p. 234.

[536] Already in 1988, Florian Rötzer remarks that the time is come "for a new futurism of all-round communication and interaction". Rötzer, however, clear-sightedly also hints at artistic dependence on funding sources and at the necessary re-appraisal of the term 'art' in times of the emerging 'technoimaginary'. Florian Rötzer, "Technoimaginäres – Ende des Imaginären?", *Kunstforum International*, Vol. 97, Nov/Dec 1988, 64-74, p. 64-65.

> By raising questions regarding possible relationships between art and technology, the role of hardware-based devices, and the borders between art and its related fields, and creating a common ground for artists and engineers to work together as equals, we might find some answers with regard to future directions rather than the past. […] Media art is a more recent development in art. Device art tries to push media even further. By doing so, it might help to gain a better understanding of the meaning and role of art in a media society.[537]

Rhetorically, Device Art is located not far from Honda's ASIMO. Device artist Nobumichi Tosa discreetly breaks with this hype about progress and future in his simplistic music devices of the *Tsukuba Series*: "Tsukuba music is designed to stir people's attention to notice the fact, 'the live musical sound is created from a substance', which the music once used to be in years past and [which one has] totally forgotten."[538] A bit awkwardly, Tosa puts emphasis on his musical 'device' as the 'substance' issuing sound. And yet, in spite of its emphasis on 'playfulness', Device Art is described as adhering to a "real future" in a presumably Derridian sense.

> There are two kinds of future, says Derrida – *la future* – that future that is in some sense predictable, measurable, probable, and *l'avenir* – which is totally unexpected and according to his way of thinking the real future. Device Art artists from Japan work on the aspect of the unexpectedness and unpredictability of our future for with their chic inventions and their mass distribution they can contribute to changing it.[539]

Unpredictability is acknowledged, Device Art will help. Curators and engineers, not only within the framework of CREST-funded research projects, lean toward rhetorics of visionary technology. In that, they represent a whole branch of media art operating at the borderline to the R&D sector drenched in progress-oriented ideology. After all, festivals and media art awards are sponsored by the industry. They widely serve as platforms to promote technological research.[540] Media art's master narrative of a better future here can only be an unbroken one because of its intrinsic entanglement with technology and with a whole field grounded on a firm belief in progress.

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[537] Machiko Kusahara: "Device Art. A New Form of Media Art from a Japanese Perspective", *intelligent agent* (2006), Vol. 6, No. 2, online source: www.intelligentagent.com/archive/Vol6_No2_pacific_rim_kusahara.htm.

[538] www.maywadenki.com/concepts/what_tsukuba.html.

[539] Description of Device Art from Japan in the catalogue of its Croatian counterpart on the occasion of the 2009 international Device Art exhibition in Zagreb: Ivana Bago et al. eds., *Device_art 3.009*, exh. cat. (Zagreb 2009), p. 9. See also online: www.kontejner.org/device-art-3009-koncept-english.

[540] This was once more and quite obviously manifested in the Ars Electronica festival 2010, this year mainly staged on the grounds of Linz' old tabacco factory, which was reminiscent of a mélange of popular fair and technology exhibition, ale-benches and barbecue stands standing side by side with local companies presenting their products.

Sci-Art as Critical Instance

Philosopher Alfred Nordmann elaborates on "a present whose future consists mainly in technoscientific promises"[541]. He consequently calls on the humanities and especially on the arts as a mandatory and dissenting voice. Nordmann, member of an inter-disciplinary research group at South Carolina University focusing on societal and ethical implications of nanotechnology, puts forth a critique of a highly disparate field subsumed under the term 'nanotechnology' and its visionary mechanisms.[542] Accordingly, the arts should unfold their potential of questioning the "playful space of possibilities" opened up by the technosciences.[543]

Critical evaluations like his are largely supported in the field of 'art and science'. Ingeborg Reichle mentions "a few artists who are absolutely not satisfied with the roadmap of a seemingly determined, technologically grounded concept of life [within the life sciences] and who tenaciously seek and offer alternatives".[544] The bioart theorist juxtaposes these "few artists" with "artists who collaborate with the life sciences" like Eduardo Kac or The Tissue Culture & Art Project and observes that "[t]hese artistic approaches raise ethical questions with regard to both scientific and artistic endeavors".[545] Her skepticism toward a new understanding of the 'human nature' produced by the life sciences gives cause for wondering about where progressing technologies will lead us:

> As long as ever-new technologies to manipulate life are invented and technology undergoes further development, and with these changes the magnitude of nontransparency increases, which is the case especially with ethically precarious technologies like genetic and reproduction technologies, the metaphorical overwriting of their myths will not cease.[546]

In her theoretical approach Reichle is concerned with "new conceptions of nature" brought about by the technosciences as discussed by scholars like Latour and Haraway. She joins the camp of those hoping for bridges to "be built between the Two

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[541] Nordmann 2009, p. 8.

[542] As an alternative label to 'nanotechnology' Nordmann proposes the term 'nanotechnoscience': Alfred Nordmann in interview, "Die Philosophie des grauen Schleims", *Die Zeit*, Nov. 15, 2007, p. 41. See already Hayles 2004, p. 14.

[543] Nordmann 2009, p. 21.

[544] Reichle 2009, p. 89.

[545] Ibid., p. 35.

[546] Ibid., p. 58.

Cultures and between science and art, but also between science and its technologies and our everyday life so that we are better prepared for the emergence of a bio-cybernetic humanity".[547] Reichle's statement seems to mirror John Dewey's remark of the 1930s that the "scientific method as now practiced is too new to be naturalized in experience", just like the media artists Sommerer and Mignonneau wish to offer "intuitive experiences of the nanoworld" through their interactive installation *Nano-Scape*.

Reichle and Nordmann ascribe a similar role to the arts within the scientific context as does art historian Sabine Flach who focuses on their critical function in analyzing image traditions and symbolic practices of knowledge production.[548] This critical potential is most often parallelized with a hope of a dialogue between the 'two cultures'. Many expectations in this context have been laid on 'art and science' collaborations. Declaring the necessity to evaluate the epistemological and ontological status of practices between the boundaries of art and science, Edward Shanken encourages such forms of "hybrid research" as indispensable for the future.[549]

One can discern at least two conceptions of art with respect to a changing and technologized present in modernity. The first one of art as a counter-world in many ways opposes that of a utopian vision for art in an age to come. As shown above, much of art connected to technology and design is inscribed into the latter concept: 'art and technology' as a connection for the benefit of a prosperous future. While the sci-art discourse significantly seems to display both, the artistic object as enchanting experience and 'art and science' as a means of bridging the two-culture gap, I want to take a second look at sci-art's future vision. For this, I consider three positions as cornerstones of a representative triangle: Peter Weibel's early image of the counter-worlds offered by Virtual Reality, the technosciences, *and* art as liberating forces from the "fetters of reality"; Stephen Wilson's seminal publications on the topic of 'art and science'; and Eduardo Kac' successful positioning in this field with his 'transgenic art'.

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[547] Ibid., p. 216.

[548] See e.g. Sabine Flach, "WissensBilder - Die Doppelhelix als Ikone der Gegenwart", in: Elke Bippus, Andrea Sick, eds., *Industrialisierung - Technologisierung von Kunst und Wissenschaft* (Bielefeld 2005), 64-82, esp. p. 80.

[549] Shanken 2006, esp. p. 13.

1990's edition of the annual Ars Electronica Festival had been drafted around "Digital Dreams – Virtual Worlds". With its outlook it contrasted Ars Electronica 91, which discussed developments "Out of Control" – "consequences of technological progress" and "dangers in an increasing mechanization of life". The festival in 1991 "differ[ed] greatly, in terms of subject matter, from all former and indeed from all coming festivals [… posing] the fundamental question as to whether technological development only has positive aspects, as the technocrats have us believe".[550] Co-producer Karl Gerbel hints at the festival's general optimistic vision which has been disrupted only occasionally. The Gulf War had broken into 1991's festival in times of an unleashed cultural criticism leading voices like Jean Baudrillard to his famous remarks on the war which "had not taken place". A year later, Ars Electronica had found back to a more cheerful mood. It now was staged in a beginning 'age of technoscience': "The World from Within – ENDO & NANO" read its title. Understanding itself as a "window into a new world", it introduced the "two new radical transformations of our world image" with great expectancy.[551] Imminent changes due to endophysics and nanotechnology were projected by citing K. Eric Drexler's announcement of fictitious nanomachines and alluding to physicist Richard Feynman, often quoted for his visionary speech "There's Plenty of Room at the Bottom".[552] Peter Weibel now celebrated nanotechnology and media art as pathways to a freer future.

"Technoscientific art" was around – as a term designating works of computer graphics and predecessors of artificial intelligence.[553] It is a time in which Weibel situates media art as a "transgression, a trans-scription, and transcendence of the classical arts".

> The transgression (also) has to do with the fundamental crisis of art in the age of techno-culture, which as a fundamental crisis of modernity has generated postmodernity.[554]

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[550] Karl Gerbel, Vorwort, in: Karl Gerbel ed., *Out of Control*, exh. cat. Ars Electronica 1991 (Linz: Landesverlag 1991), p. 6.

[551] "With Ars Electronica 92 and its analysis of the new branches of science endophysics and nanotechnology, Linz is opening a window to a new world." Karl Gerbel, "Ars Electronica 92 – Window into a New World", in: Gerbel/Weibel 1992, p. 6.

[552] Little more than a founding myth, Feynman's speech of 1959 is often referred to as the starting signal for nanotechnology.

[553] Cf. Frank Popper, "High Technology Art", in: Florian Rötzer ed., *Digitaler Schein. Ästhetik der elektronischen Medien* (Frankfurt Main: Suhrkamp 1991), 249-266, p. 254.

[554] Peter Weibel, "Transformationen der Techno-Ästhetik", in: Rötzer 1991, 205-246, p. 205. Five years later, Weibel prefers Heinrich Klotz' term of a 'Second Modernity' in order to describe media art's share in "the reformulation of a progressive postmodernity's critique of modernity", Weibel in Klotz 1996, p. 41.

Media art – "dynamic", "interactive", revolutionary – is contrasted with the 'classical arts', presented as a long-awaited disturbance in a discourse of power: "techno-art" against Heidegger, against Kant, against Hegel, "contra appearance as substance, contra power as truth, contra nature as necessity":

> Where the end of art, of the beautiful, of knowledge, of truth, of nature, of history, is incessantly proclaimed, it is in truth all about the end of their discursive forms. In reality, everything is just beginning.[555]

Even before the World Wide Web and with it the 'Digital Revolution' really impact popular perception, Weibel's lines testify to a general urge to locate media art within – again or still – a 'changing age'. Artists want to seize the "opportunity to focus the overall attention to the brave future"[556] while the buzzwords 'net' and 'network' are about to gain new importance due to the Internet protruding into every-day life. "The aesthetics of communication" develop "critical and creative answers in face of the technological environment"; "the modern environment", a "net of fibers, cables, and circuits of any kind" has become a "closed and yet completely open space!"[557]

Rhetorics of media art are rhetorics of an advent of the new. The 'new' is depicted in recurring phrases, references to icons of a present 'change'. Key metaphors describe the review of an epoch. Also here applies what Bollenbeck describes for cultural criticism around 1900: Reiterative terms are ideologically charged and used to articulate expectations in light of a perception of loss. The terms offer meaningful interpretations and – according to Koselleck's observations concerning the idea of 'progress' – incitement for action.[558]

But in contrast to *Kulturkritik* around the turn of the past century, rhetorics of media art are both, a diagnosis of radical change (often apprehended as menacing) *and* an embrace of the newly possible (or an announcement of the saving antidote). If the appraisal of the present is not positive, then there is at least a positive potential in the modifications due to science. The 1990s, the decade of the great institutionalization of media art, are also the decade in which 'emerging' technosciences gain popular ground. While the cybernetics discourse still pervades much of media art, references to nanotechnology, the life sciences, the "molecular revolution" gain in importance.

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[555] Ibid., p. 245-246.

[556] Fred Forest, "Die Ästhetik der Kommunikation. Thematisierung der Raum-Zeit oder der Kommunikation als einer Schönen Kunst", in: Rötzer 1991, 323-333, p. 324.

[557] Ibid.

[558] Bollenbeck 2007, p. 205-206.

Artist and theorist Roy Ascott refers to Drexler's "Engines of Creation" when he reflects on "the new definition of life" brought about by the recent technological development. Nanotechnology's promises "suggest to artists some of the most radical consequences since the publication of Norbert Wiener's *Cybernetics* in 1941".[559] Calling for a new definition of 'nature', Ascott partakes in a trend of his time. Donna Haraway has ongoingly pondered upon this 'new nature' ever since her *Primate Visions: Gender, Race, and Nature in the World of Modern Science* in 1989. After his early works in laboratory studies, Bruno Latour had moved to a more philosophical reflection on social and natural worlds, especially since *We have never been modern* (1991). The discussions of the 'posthuman' were joined by numerous scholars, notably by literary critic N. Katherine Hayles.[560] Reassessing the Cartesian dichotomy of nature and culture, these positions primarily represent a preoccupation with possible impacts of 'change' – due to virtual worlds, due to biotechnology, due to just these reassessments of 'nature'. Accordingly, novel modes of thinking in our techno-scientific age set the human into a new relation to 'nature' which is no longer conceived as a *natura naturans*.

Sci-art starts off on these grounds. Artists like Ascott – "in creative participation in the molecular age of the future" – are ready to "return to nature in the 21st century": "nature II".[561] Nature II will be a "new nature" which includes artificial life in a world revolutionized by nanotechnology and "engines of creation" as envisioned by K. Eric Drexler.[562] "Laws of time and space" reputedly can now be bypassed, thanks also to the new art form's contribution ("art of the telematic culture" in Ascott's case).[563] Ascott's and Weibel's euphoric tone of the early 1990s resonates within the general media art discourse. Scientifically oftentimes completely off the mark, handling catch phrases like 'space-time' or 'quantum mechanics' (condensed to weighty labels)

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[559] Roy Ascott, "Zurück zur (künstlichen) Natur", in: Gert Kaiser et al., eds., *Kultur und Technik im 21. Jahrhundert* (Frankfurt Main and New York: Campus 1993), 341-355, p. 344.

[560] E.g. N. Katherine Hayles, *How We Became Posthuman. Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago and London: University of Chicago Press 1999).

[561] Ascott 1993, p. 344. Ascott here expresses a similar sentiment which Douglas Davis stated in 1973: "Technology, now, is our environment, our landscape.", Davis 1973, p. 16. Also the 'art and technology' discourse is interrelated with evaluations of a new 'nature'. Japanese gadget art is set in relation to the appreciation of a (technologized) environment, see Chapter I. Finally, also the Ars Electronica festival took up the debate, especially in its "Human Nature" edition in 2009.

[562] Ibid.

[563] Ibid., p. 347. The "new art" promoted here is opposed to 'mainstream' art such as traditional painting etc. which for Ascott created a "cultural membrane that held us off the occurrences in nature", p. 343.

allows an adornment with the thrivingly 'new' in science.[564] In order to substantiate this point for the field of 'art and science', it should be noted, however, that there is also another discursive branch originating in the media art context during the 1990s: the late-futurist rhetoric employed by artists-theorists like Peter Weibel and Roy Ascott are opposed by a surfacing critical appraisal of this futuristic preponderance in the media art discourse (for example in the context of *transmediale* festival in Berlin, culminating in 2011 edition's ironic title "Futurity now").[565]

When interactive nanoart comes up in the early 2000s, media art is no longer in its infancy. It is well institutionalized by now.[566] 'Art and science' is omnipresent, leading critics finally to declare the obsolescence of C. P. Snow's model of the "two cultures".[567] Artist and theorist Stephen Wilson takes Snow as a starting point in order to elaborate on art, science, technology, and 'art as research'. His compendium of innumerable artistic positions – ranging from bioart, "post-human approaches", and works with GPS, to robotic art, telematic art, and Artificial Intelligence – is meant to be a critical appraisal of this emerging field as well as a reference book.[568] Wilson's overview is representative in being interspersed with the occasional question on the outcome of the positions discussed, the general tone is positive and forward-striven. Due to the author's long-time involvement as a media artist his emphasis on the innovative powers of art also mirrors a desire for self-legitimization. Compared to his European colleagues Wilson's promotion of this niche of art, however, comes about in a much more sober and practical language calling artists to a deeper and more daring involvement in science. Chronology is neglected in favor of thematic classification placing Land Art of the 1970s next to Solar Art of the 1990s.[569]

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[564] Cf. also Linda Dalrymple Henderson, *The fourth dimension and non-Euclidean geometry in modern art* (Princeton: University Press 1983) and Henderson 2004.

[565] I thank Dieter Daniels for insisting on stressing this important differentiation within an all but heterogeneous discursive terrain.

[566] E. g. Naimark 2003; Daniels 2011.

[567] Cf. e.g. Horst Bredekamp, *Antikensehnsucht und Maschinenglauben. Die Geschichte der Kunstkammer und die Zukunft der Kunstgeschichte* (Berlin: Klaus Wagenbach 1993), p. 102; Oliver Grau, "Auf dem Weg zur Bildwissenschaft", *Gegenworte. Hefte für den Disput über Wissen*, Spring 2002, No. 9, 25-29, p. 25.

[568] Stephen Wilson, *Information Arts. Intersections of Art, Science, and Technology* (Cambridge MA: MIT Press 2002).

[569] Ibid., p. 245-246.

Like most promoters of art and science, Wilson stresses both, art's function as a critical commentary of science *and* art as an entity fostering research and bringing about innovation in science and technology. 'Cultural' implications of this artistic engagement are to be found in its "philosophical notions of what is to be human, the nature of time and space".[570] References to Michel Foucault, to the 'deconstruction of narratives', and to the debate of posthumanism are an attempt to close the gap between art practices and a dominant theory discourse.[571] Without going any further in depth into the vast theory corpus they cite, these rhetorical connections represent a general struggle for a legitimization of sci-art practices in confrontation with a constant obligation to justify such endeavors.

Tropes of breaking down disciplinary boundaries as in countless other contributions on this subject stand side by side with those of critical commentary and of advancing research. These core topics (interdisciplinarity, critique, participation in scientific progress) constitute the textual framework into which are inserted a broad variety of artistic proposals.[572] All of this points straight into an imminent future:

> This is research's era. Inquiry and innovation are breathtakingly in their reach. The future promises to be even more remarkable than the recent past. […] The artists […] are beginning to engage that world of research in profound ways. They are reclaiming art as a zone to question and innovate – even in a world dominated by science and technology. They have begun to enter research not only to use its gizmos or to critique its blindnesses but also to help shape its future.[573]

Below the line, it shows an art which lives off science's belief in progress and in the endless opportunities of the technosciences.

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[570] Stephen Wilson, "Artists and Biology Research", web-based presentation at ISEA 2006, San Jose, CA, online source: userwww.sfsu.edu/~infoarts/links/isea2006bioartf/art.bio.isea.06web.html.

[571] Wilson 2002, esp. p. 79-80. Artists "are questioning the conceptual frameworks, deconstructing the language used, and unveiling the web of connections between this research and larger cultural structures.", Stephen Wilson, "La contribution potentielle des bioartistes à la recherche", in: Louise Poissant and Ernestine Daubner, eds., *Art et biotechnologies* (Montreal: Presses de l'Université du Quebec 2004), 335-351, p. 338.

[572] Cf. also Stephen Wilson, *Art + Science Now* (London: Thames & Hudson 2010). In this coffee table publication Olafur Eliasson's *Weather Project*, not exactly what one usually understands by art and science, is represented as well as Sachiko Kodama's <*Protrude, Flow*> or Paul Thomas' *Midas*.

[573] Wilson 2002, p. 875. And eight years later: "Consider some of what we may confront: invention of new species; […] 'post-human' enhancements to human bodies and brains; […] robot companions; construction of materials atom by atom […]. Imagine what kind of art will answer these challenges. Like science, it too will be revolutionary and experimental, daring to venture into unexplored terrain.", Wilson 2010, p. 201.

While its head reaches high into times to come, the rhetorical lining of 'art and science' grounds its feet firmly upon the avant-gardes of the 20th century. Bioartist Eduardo Kac for example joins the genealogy of Marcel Duchamp, László Moholy-Nagy, and the futurists in search of situating his early 'telepresence art' within "poststructuralism", and an open "non-Euclidian space" in the epoch of the network.[574] Being a model bioartist not least because of his provocative art projects like the implantation of a microchip ("time capsule") into his left leg or his fluorescent gene-bunny,[575] Kac is mentioned in any major publication on sci-art. Kac' presence might on the one hand be explained by his active participation in the bioart discourse. On the other hand, bioart has emerged as *the* dominant sci-art as it addresses the focus of popular interest in the booming technosciences – on the life sciences including biomaterials, genetic engineering, and medical devices. It is thus no surprise that a number of publications on sci-art is mainly focused on bioart and its fringes.[576] Various publications,[577] symposia, and exhibitions[578] on bioart have been staged in the past decade. Ars Electronica has explicitly devoted its annual festival to life science and related issues: first and foremost "LifeScience" in 1999 and "Human Nature" in 2009.

Authors in this field reflect upon postmodernity as 'biomodernity'. The corpus of theoretical and philosophical positions to which artists, curators, theorists revert is much influenced by Haraway's and Latour's deliberations on the conception of 'nature' and 'life' – conceptions which are perceived as necessarily changing in an

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[574] Eduardo Kac, *Telepresence & Bio Art. Networking Humans, Rabbits & Robots* (Ann Arbor 2005), p. 4-24. Linking 'art and science' and the avant-gardes see furthermore: Wilson 2002, esp. p. 499, 655-656; Witzgall 2003, esp. p. 298-302; critically on this connection: Reichle 2009, p. 213. However; on the "biological 'ready made' in terms of Duchamp": Ingeborg Reichle and Frank Rösl, "Wissenschaft und Kunst. Eine interdisziplinäre Annäherung", *Gegenworte. Hefte für den Disput über Wissen*, Spring 2010, No. 23, 12-15, p. 14.

[575] *Time Capsule*, 1997; *GFP Bunny*, 2000.

[576] The chapter discussing media artistic positions in Susanne Witzgall's book is dedicated to the biosciences, Witzgall 2003, esp. p. 267-277; Sabine Flach has published a good deal specifically on art and life science: cf. e.g. Sabine Flach and Sigrid Weigel, eds., *WissensKünste. Life Sciences – Kunst – Medien* (Weimar: VDG Publ. forthcoming); Ingeborg Reichle's *Art in the Age of Technoscience* finally is almost exclusively dedicated to the biosciences.

[577] Among others e.g. Dmitry Bulatov ed., *Biomediale* (Kaliningrad: National Publishing House 2004); Louise Poissant and Ernestine Daubner, eds., *Art et biotechnologies* (Montreal: Presses de l'Université du Quebec 2004); Melentie Pandilovski ed., *Art in the Biotech Era* (Adelaide: Experimental Art Foundation 2008).

[578] E.g. "Paradise Now: Picturing the Genetic Revolution" at Exit Art New York in 2000; "L'Art Biotech" at Le Lieu Unique, Nantes, France in 2003; "sk:interfaces" at the Foundation of Arts and Creative Technology, Liverpool in 2008.

epoch of biotechnologies. Their positions serve as a source of reference for texts[579] in which 'art and science' is not seldom implicitly equated with bioart.[580]

With his transgenic works Eduardo Kac indeed contributes directly to the debate by presenting a genetically manipulated bunny or a mutated gene in a petri dish as art. The artist hopes to ambivalently engage in the discussion on the ethics of genetic engineering and strives for a differentiated view upon the issue.[581] Assuming the authorship for his commissioned manipulations on genes and rabbit, Kac benefits from the image of the 'mad artist-scientist' when he poses for photographs with the gene-bunny Alba in his arms.[582]

> That means that artists can not only combine genes from different species […]. The artist literally becomes a genetic programmer who can create life forms by writing or altering a given sequence.[583]

When Sabine Flach states that Kac and other bioartists confront science with its simulations and mises-en-scène, "with their image",[584] she is absolutely correct, omits, however, that bioart also cashes in on just this 'image' of science.[585] Not only through his creations but also rhetorically Kac propounds transgenic art – "the literal creation of and responsibility for life"[586] – as an art indebted to life science. But he emphasizes the role of his work primarily as critical input to contemporary debates.[587] In

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[579] Cf. e.g. Wilson 2002, p. 76; also the chapter "Aufhebung der epistemologischen Basis der Wissenschaften", Witzgall 2003, 291-295; Reichle 2009, esp. p. 6-8.

[580] Cf. Wilson 2004, p. 336: "Les bioarts apparaissent particulièrement importants à cause de l'impact potentiellement révolutionnaire de cette recherche dans les prochaines décennies".

[581] "I call the creation of artwork that produces ethical tension and stimulates reflection and debate 'performative ethics'.", Kac 2005, p. 254. See also ibid., p. 272-274.

[582] Kac makes a point of including the ensuing discourse around his art into the artwork itself, specifically in the case of his gene-bunny Alba, which caused some response in the media; Kac 2005, p. 264 and the following. On the image of the 'mad scientist' and symbolic orders of knowledge cf. Sarasin 2003, 231-257.

[583] Ibid., p. 242-243. This quote is part of a text written in 1998 on Transgenic Art. In articles on the works *Genesis* (1998/1999) and *GFP Bunny* Kac does mention the scientists involved in the technical implementation of his works either in footnotes or in the main text.

[584] Sabine Flach, "'It's not easy being green!'. Schnittpunkte von Kunst, Medientechnik und Naturwissenschaften am Beispiel der Transgenic Art", in: Martina Heßler ed., *Konstruierte Sichtbarkeiten. Wissenschafts- und Technikbilder seit der Frühen Neuzeit* (Munich 2006), 281-302, p. 302.

[585] A look at the design of book and catalogue covers in the 'art and science' and bioart sector should substantiate this point.

[586] Kac 2005, p. 277.

[587] Kac makes a point of considering the ensuing discourse around his artworks as an integral part of them.

commentaries on the function of his bioart he himself does not seek to establish bioart as a contribution to future research.

Next to Eduardo Kac, also the artists Oron Catts and Ionat Zurr are prominent representatives of bioart. Active 'in the laboratory' at SymbioticA, University of Western Australia, Catts and Zurr of 'The Tissue Culture and Art Project' pursue a line of argumentation similar to that of Kac. In their works with artificially grown tissue, they stage the life sciences quite literally in the exhibition space by using emblematic set ups reminiscent of the biology lab. Their art is meant to "play an important role in generating a cultural discussion in regard to these issues".[588] In a text on 'The Art and Science Collaborative Research Laboratory' SymbioticA, however, art and tissue engineering are not just partners in critical tension:

> The interaction of art, science, industry and society is recognized internationally as an essential avenue for innovation and invention, and as a way to explore, envision and critique possible futures. […] There is a need for artists and other professionals in the humanities to actively participate in research into possible and contestable futures […].
>
> SymbioticA welcomes […] artists and scholars to work in interdisciplinary research teams exploring new directions for new technologies and the effects on society that they might have.[589]

Depending on the genre of the text, the bioart work's descriptions differ. Sometimes societal critique is their main focus, sometimes, especially when they are set into a broader framework, future-bound vocabulary of science and technology dominate their interpretation. Critical artworks are then merged into the language of research proposals, a language soliciting the futuresque.

This is not to say that Catts' and Zurr's work does not bring up critical aspects as shows for example their *Extra Ear – ¼ Scale* created in 2003 in collaboration with the artist Stelarc. There is a variety of artistic positions which *does* address the monstrous in bioscience, the precarious of surveillance technology, or problematic scenarios in artificial intelligence.[590] The Critical Art Ensemble, for example, has ongoingly

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[588] Ionat Zurr and Oron Catts, "The ethical claims of Bio Art: killing the other or self-cannibalism", *Australian and New Zealand Journal of Art*, vol. 5, no. 1: *Art & Ethics*, 2004, 167-188, p. 186.

[589] Oron Catts and Stuart Bunt, "SymbioticA. The Art and Science Collaborative Research Laboratory", in: Gerfried Stocker and Christine Schöpf, eds., *Take Over. Who's Doing the Art of Tomorrow*, exh. cat. Ars Electronica 2001 (Vienna and New York: Springer 2001), 132-135, p. 132.

[590] E.g. Catherine Chalmers' series of photographs of *Genetically Engineered Mice* (2000), although like the artist Suzanne Anker, Chalmers works with traditional media and not in the periphery of the

promoted forms of "Electronic Civil Disobedience" in various performances, installations, and video works. Not least because of the arrest of Steve Kurtz, one of the Ensemble's founders, on suspicion of bioterrorism, the collective's actions have been widely covered by the press in 2004. The artists operate on a highly critical and certainly not affirmative level, in contrast to the impression left by other, oftentimes more iconic, sci-art works.

It would, however, be worthwhile to deliberate on the question of 'self-empowerment' and the autonomy of the means of production in this context. Compared to other media art which does not operate in the science context, the aspect of the manageability of the technology addressed by – or employed by – the artwork has to be regarded in a completely different light when it comes to nanoart and bioart. While the often-quoted "autonomy of the means of production" originating in the Marxist rhetoric predominant for example in Bertolt Brecht's radio theory and persisting in a leftist media art discourse is still highly relevant for certain branches of media art (for example in Internet art), the high technology addressed in typical works of 'art and science' is obviously only manageable in co-operation with trained scientists and poses the question of the artist's dependence on external know-how.[591]

I certainly do not want to deny the possibility of critique in artworks operating at the borderline to the laboratory. My point is that the very junction of art and science, however, inevitably brings about an indebtedness to its second compound 'science', most often entailing rhetorics and beliefs which it allegedly antagonizes in many instances. In the second chapter I have illustrated to which extent nanoart is no exception here. Its discursive framework is full of (techno)scientific promises.[592] Albeit many works do so in a fractured way, bioart represents the bioscientific paradigm.

Nanoart surfs on a similar wave.

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laboratory; Natalie Jeremijenko's work in the field of surveillance and data technologies; or Adam Brandejs' *Genpets Series 01* of 2005 – again, however, not an artwork created in or in dependence on the laboratory.

[591] Cf. Daniels 2002; see also on the question of media art and the 'avant-garde': ibid., "Reverse Engineering Modernism with the Last Avant-garde", online source, www.netzpioniere.at/node/43.

[592] Although, choosing a work-immanent perspective of interpretation, one might argue that many of the sci-art works may potentially be more substantial and complex than the discourse into which they are embedded. This also concerns the omnipresent question of the validity of an intuitive access to the works versus the analysis of its discursive superstructure. For methodological reasons and reasons of personal interest, I have set my focus on the discourse, i.e. textual sources. A study analyzing the works on the basis of sensorial aesthetics and theories of perception might bring up quite different aspects.

> Nanotechnology is a brave new world and within it there are dangers and immense opportunities to change not only world economy, but the entire structure of society and the environment of the planet. It has no clearly articulated vision or direction and is generally not understood but greeted by wonderment, curiosity, fear and distrust […].[593]

In "this empty space of nano"[594] artistic installations are pointing toward the 'brave new world' evoked. "Interaction per se" is outlined as "the driving force for any productive activity and progress"[595] while interactive artworks are described in texts characterized by an attire of research reports.[596] The textual framing of *Midas Project* by artist Paul Thomas, created in collaboration with scientists at SymbioticA, is in many ways exemplary. It is interspersed with references to modernity's avant-gardes (to the Technical Manifesto of Futurist Painting), to the dissimilar godfathers of nanotechnology Richard Feynman and K. Eric Drexler, to posthumanism, N. Katherine Hayles and Roy Ascott, to artists that "have now taken up the transformative potential of nanotechnology as an issue".

> Nanotechnology offers us new ways of exploring spatiality while recapitulating the pervasive presence of perspectival space. The *Midas* project deconstructs, investigates and even maps the challenges of post-perspective spatialities.[597]
>
> […] Twentieth-century artists continually attempted new modes of visual representation. However, they failed to reconfigure the pervasive presence of perspectivally driven objectification of the world. The task is now engaging 21st-century media artists in manipulating spacial paradigms. […] Nano art in general allows for a reconfiguring of our conscious understanding of space, which is our lived experience, generating the potential for new spatial understanding.[598]

'Art and science' – nanoart, bioart, Artificial Intelligence, et cetera – is the artistic reflection of a time understood as an 'age of technoscience': technoscience having long become an unquestioned defining term for our "epoch".[599] Whether a historical turning

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[593] Website of Vesna's and Gimzewski's work *Zero@wavefunction*, notime.arts.ucla.edu/zerowave/zerowave.html.

[594] Website *Bluemorph*, artsci.ucla.edu/BlueMorph/concept.html.

[595] Comment on *Nano-Scape* by Sommerer and Mignonneau, www.interface.ufg.ac.at/christa-laurent/WORKS/FRAMES/FrameSet.html.

[596] Cf. Sommerer & Mignonneau 2005; Thomas 2009.

[597] Thomas 2009, p. 186.

[598] Ibid., p. 192.

[599] Cf. Weber 2003 (following Haraway), p. 135: "Wenn ich auch keinen derart radikalen Bruch zwischen Moderne und Technoscience sehe, wie er gemeinhin zwischen Mittelalter und Neuzeit angenommen wird, insofern u.a. sich die epistemologischen Grundlagen von Wissensproduktion nicht in der gleichen radikalen Art verändern, so lässt sich meiner Meinung nach dennoch rechtfertigen, von der Technoscience als einer neuen Epoche zu sprechen." Also ibid. p. 136: "Den Begriff *Technoscience*

point[600] or a new mode of narration, 'technoscience' marks novelty reaching into the time yet to come. Noteworthy here is the interconnectedness of cultural criticism and an assessment of the 'future'. Donna Haraway reflects upon this relationship and narratives pondering on technoscience:

> […] I am appealing to the love/hate relation with apocalyptic disaster-and-salvation stories […;] I consider figures to be potent, embodied – incarnated, if you will – fictions that collect up the people in a story that tends to fulfillment, to an ending that redeems and restores meaning in a salvation history. […] I think contemporary technoscience in the United States is deeply engaged in producing such stories, slightly modified to fit the conventions of secular realism."[601]

Feminist Haraway analyzes "writing technology" as the problematic construction of presumed ontologies. However, while she explicitly aims at de-essentializing techno-science and critically understands it as a "mutation in historical narrative"[602], above all, she perceives the 'now' as an age of fundamental change:

> In the imploded time-space anomalies of late twentieth-century transnational capitalism and technoscience, subjects and objects, as well as the natural and the artificial, are transported through science-fictional wormholes to emerge as something quite other. Even drenched with all the hype about revolution and technoscience that pervades contemporary discussion, the ferocity of the transformations lived in daily life throughout the world are undeniable.[603]

Technoscience casts its shadow. While Haraway, Weber, or Hayles critically think about the implications of standing in a line of tradition in historical writing, with the choice of their topic they augur a future. This future is both, moving toward us in menace *and* a potential space of open possibilities.[604] Apocalyptic visions of technoscientific developments and their evaluation are two sides of the same coin. They are efforts to situate the self within the now with respect to the future.

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halte ich für am besten geeignet zur Bezeichnung der Gegenwart, insofern er den unseligen Streit um Moderne versus Postmoderne vermeiden kann, welcher neben einem Kampf um die Definition der eigenen Zeit auch als geschichtsphilosophische Kontroverse um die Alternative von Bruch und Kontinuität interpretiert werden kann."

[600] Ibid., p. 135.

[601] Donna J. Haraway, *Modest_Witness@Second_Millennium. FemaleMan©_Meets_OncoMouse™. Feminism and Technoscience* (New York and London: Routledge 1997), p. 43-44.

[602] "I use technoscience to signify a mutation in historical narrative, similar to the mutations that mark the difference between the sense of time in European medieval chronicles and the secular, cumulative salvation histories of modernity.", ibid., p. 3-4.

[603] Ibid., p. 4.

[604] Cf. also Weber 2003, esp. p. 292-294; Hayles 1999, esp. p. 283-291.

The history of 'art and science', indebted to narratives of radical change and potential future scenarios, thus has never let loose of the chronotope of progress. Media art's narration of the future, albeit addressing possible 'dangers' and 'risks', utilizes powerful tropes of technological development for its own purposes and mirrors phrases of futuristic science. It cannot escape the discursive framing of technoscience because it lives off it. 'Art and science's' necessity of a capacious theoretical lining – something related to Adorno's supposition that "art stands in need of philosophy that interprets it in order to say that which it cannot say, whereas art only is able to say what it says by not saying it"[605] – brings about a convolute of reflections upon the technoscientific and art's role for a dooming age. After all, the perpetuation of modernity's concerns is not surprising in a field involved in science and its progressive visions. Authors of the early 20th century dealt with art as a counter-world or finally succumbed to the wish of integrating art and science into 'experience'. Artistic endeavors like the *Experiments in Art and Technology* of the 1960s worked on just this integration.[606] The striking prevalence of similar rhetorics, a due mobilization of art in a technoscientific age, stocktaking in a present evaluated as high-speed transformation, and the depiction of possible futures – all this re-installs media art as an art of the future.

Ontologies II: 'Experience'

An analysis of media art's role today, of ascriptions to and hopes set upon it in a long-lasting age of disenchantment, inevitably brings about the question of narratives in 20th-century art from futurism to 'art and science'. Musing about media art's discursive positioning with tropes often reaching back to modernity, I myself position it in a constructed historical narration insinuating cause and effects, influences, relationships. By shedding light on certain categories and ideas, which I consider key concepts for my perspective on the matter, I leave out others and thereby benefit from an author's sovereignty of interpretation. Throughout the dissertation I have tried to avoid unjust generalization by staying close to the research material of my case studies. However,

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[605] Theodor W. Adorno, *Ästhetische Theorie* (Frankfurt Main: Suhrkamp 1973), p. 113 cited in translation by Gerhard Richter, "Aesthetic Theory and Nonpropositional Truth Content in Adorno", *New German Critique* 97, Vol. 33, No. 1, Winter 2006, 119-135, p. 122.

[606] Cf. accordingly Davis in *Art and the Future* 1973: "Their [i.e. art's and science's] inner logic demands pursuit of the future, since both are essentially engaged in the discovery and promulgation of truths ignored by other parts of society.", p. 178.

although I am merely composing a fractured narration, I have to be conscious of the fact that there still remain master narratives in the background, especially for this third chapter which departs from the micro view of an art sociological approach and attempts interpretative extrapolation. I finally want to single out a second key concept of the 20th-century art discourse in order to reflect upon its significance for media art. Above, ontological questions have arisen in the context of the 'sublime' in art theory and religious residues in sci-art works. While the Western debate on art's status (being not a 'thing among things', but charged with a surplus) raises questions of pseudo-sacred functions of the artwork,[607] 'experience' has always been a pivotal category in the attempt to approach art's ontological givens.

'Experience' is a term of immense importance in modernity, a time of bemoaned 'estrangement' suffering from the consequences of industrialization and ratio-nalization.[608] It becomes increasingly important precisely in an age of emerging mass phenomena – the metropolis, transportation, or the political mobilization of the masses –, aims at reinstalling the individual as a significant entity, while the modern art object is now confronted with the 'disenchanted' mass product. The turmoil of industrialization and modernization is accompanied by efforts in art and design to integrate life and art – as reflected in ideas like that of the Arts and Crafts movement, or later the Bauhaus. 'Experience' connects the individual with an often symbolically charged *vis-à-vis*. The American intellectual John Dewey introduces 'esthetic experience' in quest of a renewed sublimation of life. Like the integrators of industrial design and art, he believes in increasing prosperity by grace of science, the "organ of general social progress".[609] Yet while the pragmatist insistently promotes the "scientific attitude" against all contemporary adversaries, according to him only art is able to express the "inner nature of things". This specificity, a quality of expression unique to art, is what makes art exclusive in its "moral potency".[610] Proclaiming art's

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[607] Seminal in this debate see of course Arthur C. Danto, *The transfiguration of the commonplace. A philosophy of art* (Cambridge, MA: Harvard University Press 1981) and ibid., *Beyond the brillo box. The visual arts in post-historical perspective* (New York: Farrar Straus Giroux 1992).

[608] E. g. in the more and more significant popularization of science in the 19th century (cf. chapter II; Raichvarg/Jacques 1991, p. 194 and the following), or in youth movements longing for a liberation of modernity's constraints. Max Weber's lecture "Science as a Vocation" recurringly alludes to the youth's frenetic striving for *Erlebnis* in a disenchanted age – an age which nevertheless is highly skeptical toward science, times of new spiritual movements countering the omnipresent authority so "alien to god".

[609] After Toumey 1996, p. 35-36.

[610] Dewey 1934, esp. p. 88 and 349.

fundamental role for a future well-being he installs it as "a mode of prediction not found in charts and statistics".[611] Also Dewey advances sublimated aesthetic experience through a language infused with religious terminology: "'Revelation' in art is the quickened expansion of experience. […] Art is the extension of the power of rites and ceremonies to unite men, through a shared celebration, to all incidents and scenes of life."[612] He underlines the necessity of integrating 'esthetic experience' into every-day life in a time in which the aesthetic autonomy of "experienc[ing] pleasure without interest"[613] is challenged. Artistic practice, design, and art theory for a while now have debated the "perpetual question of whether the labor of industrial production and the labor of cultural production can and should be related"[614], in which respect art could or should penetrate every-day life while conserving its uniqueness. The omnipresence of the term 'experience' mirrors the tensions between rationalization and subjectivity.

Dewey's emphatic plea for art's importance in an epoch dominated by technological thought resonates until today. He is quoted not least in contributions to the debate on artistic research.[615] Experience as a central category in this context is then endowed with knowledge-producing capabilities.[616] Contributions on 'art and science' in turn highlight not only art's innovative and creative potential, but also its distinctive quality of accessing the non-rational. In Niklas Luhmann's reflections on art a similar notion is mirrored in the term 'perception', another category beyond the articulable.[617] At large, all positions pivot around the same premise: Art stimulates extra-ordinary, that

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[611] Ibid., p. 349.

[612] Ibid., p. 270 and 271.

[613] Benjamin Buchloh, "The social history of art. Models and concepts", in: Hal Foster et al., eds., *Art since 1900. Modernism, Antimodernism, Postmodernism* (London: Thames & Hudson 2004), 22-31, p. 23.

[614] Ibid., p. 26.

[615] Cf. Julian Klein, "Was ist künstlerische Forschung?", *Gegenworte. Hefte für den Disput über Wissen*, Spring 2010, No. 23, 24-28, p. 26.

[616] On the relationship of art and knowledge based on 'experience' as a key term, cf. already Böhme 1989, esp. p. 146. Also Dagmar Reichert, "Das Kunstwerk als Erkenntnis. Zum Verhältnis von Forschung und Kunst", *Neue Zürcher Zeitung*, April 3, 2010, p. 58; or Christa Sommerer, Laurent Mignonneau, "Art as a Living System", in: ibid., eds., *Art@Science* (Vienna 1998), 148-161.

[617] "So gesehen, wäre es die Funktion der Kunst, etwas prinzipiell Inkommunikables, nämlich Wahrnehmung, in den Kommunikationszusammenhang der Gesellschaft einzubeziehen." Niklas Luhmann 1997, p. 227; see also p. 13 and the following pages.

is, aesthetic, experience by being perceived as an object (or, more recently, a process) differing from all others. This is what constitutes its ontological character.[618]

While we encounter variations of the 'sublime' in works of 'art and science', the 'art and technology' scene seems to display much less of it. Its adjancency to the research and development sector entails a language inclined toward the practicality of applied research. The notion of 'experience', however, is vital for this field. In the context of Japanese gadget art, for example, Machiko Kusahara even raises the question of "'sublime' experience" in relation to the artwork as a multiple. In her promotion of Device Art, 'experience' becomes the hinge term connecting user and commercialized art object.

> A device could be the 'body' of an artwork that offers an artistic experience to its users / participants. In other words, the 'resulting' experience cannot be separated from the device specifically designed or chosen to enable this experience.[619]

A "whole experience" similar to an allegedly intrinsic 'Japanese' appreciation of the tea ceremony or ikebana is granted by artful devices. What the device unfolds in the age of its mechanical reproduction is beyond the ordinary: "It is problematic to separate devices from experiences if the experience is only possible through the use of devices consciously chosen for their purpose [like in a tea ceremony]."[620] In the playfulness of gadget art and in other media artworks' interactive qualities, 'experience' is presented as the fundamental trait setting apart the object or installation from the merely technological shell. The *art*work is more than its material medium, it is also a sensually experienceable structure and "the imaginative animation as aesthetic or intentional object"[621]. The adjective 'artistic' turns the engineer's research item into a work endowed with metaphysical qualities – Hiroo Iwata's *Media Vehicle*, Junji Watanabe's interface research in *Touch the Invisibles*, or "media" shown by MIT Media Lab at Ars Electronica.[622]

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[618] Cf. Adorno as quoted above; also Luhmann 1997, p. 13. See also Luhmann's discussion of esoteric positions operating with the quasi-religiously charged term 'experience', ibid., footnote 230, p. 490-491.

[619] Kusahara 2006, n. p.

[620] Ibid.

[621] Jan-Peter Pudelek, "Werk", in: Karlheinz Barck et al., eds., *Ästhetische Grundbegriffe: historisches Wörterbuch in sieben Bänden*, Vol. 6 (Stuttgart: Metzler 2005), 520-588, p. 527.

[622] "[…] technologies that promise to fundamentally transform our most basic notions of human capabilities.", IMPETUS: Works from the MIT Media Lab, in: *Human Nature. Ars Electronica 2009*, exh. brochure (Linz 2009), p. 30.

With their "intuitive experience" nanoart installations and Device Art converge in 'the other state'.[623] This other state lies beyond any utility. Art, described by the philosophy of aesthetics as ontologically not useful (a view consolidated by Kant's analysis of a "purposiveness without purpose" as the source of art's autonomy)[624] is postulated as an end in itself and thereby closed for external references.[625] Device Art's struggle for legitimacy in the face of raised eyebrows outside of Japan is rooted in this postulate. Media art works like those of Device Art interfere not only with art's ontologically ascribed purposelessness, but also with the resulting ban on commercialization for the sake of preserving the artwork's aura. Conflicting positions are revealed by promoters of Japanese media art when they, like Yasuki Hamano, speak out against lacking Western acceptance of what the Japan Media Arts Festival hopes to see accepted as art. Whether part of a strategy to export 'contents industry' and increase the country's soft power, or due to a historically differing conception of 'art', Japanese 'media geijutsu' are confronted with the dominance of a (Western) ontologization of art.

While Japan adapted to the inflow of Western aesthetics after 1868, traditional notions of what became now described by 'bi' (as equivalent to the Western 'aesthetic') were superimposed and transformed[626] resulting in what Shikata describes as underlying persisting conceptions today.[627] 'Art' arrived as an external connotative

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[623] I borrow this term from Robert Musil whose *Man Without Qualities* is confronted with the changes of modernity. The writer retrospectively describes life in times of exceptional speed and discontinuity discussing the philosophical implications of epistemological shifts due to the natural sciences. His novel is laced with ideas of "the other state" ("der andere Zustand") and art's role in modern life. 'The other state' – experiencing the non-rational, i.e. art and aesthetic appreciation have "the task of continuously reshaping and renewing the image of the world and the comportment within this world, breaking open the formula of know-how ('Erfahrung') with its experiences ('Erlebnis')", Robert Musil, "Ansätze zu neuer Ästhetik. Bemerkungen über eine Dramaturgie des Films", in: Adolf Frisé ed., *Robert Musil Gesammelte Werke, Bd. 8 Essays und Reden*, 1137-1154, p. 1152.

[624] Buchloh 2004, p. 45; Frances Ferguson, "The Sublime from Burke to the Present", in: Micheal Kelly ed., *Encyclopedia of Aesthetics*, Vol. IV (Oxford and New York: Oxford University Press 1998), 326-331, p. 327.

[625] Luhmann 1997, p. 244-245. In the sci-art context, Reichle refers to the notion of purposelessness when she mentions art's condemnation "to an endless cycle of self-referentiality" in modernity which, however, she sees overcome today, Reichle 2009, p. 213-214.

[626] Michael Siemer, "Konkrete Abstraktionen: Takayama Chogyus Entwicklung einer eigenständigen japanischen Ästhetik im Japan der 1890er Jahre und die Verarbeitung ästhetischer Theorien des Westens", in: Lisette Gebhardt, Susanne Kreitz-Sandberg, eds., *Japanstudien 8. Interkulturelle Perspektiven Japan – Deutschland* (Munich: iudicium 1996), 53-76, esp. p. 53.

[627] "Of course, it is in a way different, getting different, because after we received the Western-based culture in Meiji era, also even now, because globalization is all over the world, we also share the same kind of culture or knowledge and information. But still each place keeps its locality and also in Japan we have our subconscious way of behaving or understanding and communicating, and expressing and how

category and as such it stands in contrasting tension with 'media geijutsu' in the 21st century. In the artistic device the mass product suddenly resorts to its antagonistically opposed: to sublimated experience. Whether original, multiple, or mass product, the device ought to operate in a remote sphere, far from the ordinary. It is not a coincidence that Device Art and other creations in the 'art and technology' field exhibited at international venues are inscribed into a line of predecessors active in a similar terrain. This is where the theoretical claim of Device Art's structural similarity for example with the Bauhaus comes in.[628] Media art then is inserted into narratives legitimizing its status between classical art object and industrial design ever since the early movements of artful crafts.

Media art is a reminder of art's historically and culturally grounded defining frontiers and a cause to re-negotiate them. Art forms ranging in border zones to purpose and utility inevitably enter troubled waters. Aesthetic experience, that is the facilitation of the beholder's 'other state' in dissociation from quotidian and rational approaches, becomes pivotal in the re-definition of what sets art apart when it is invested with the enhancement of daily life with gadgetry or, likewise, the end of knowledge generation. Analogically promoters of 'art as research', 'research through art', and 'artistic knowledge' try to extend these same delimitations of art. In constant clash with normative forces of what may be labeled 'art' and what may not, positions are oft put forth in a defensive tone and legitimatory statements facing the dominant *vis-à-vis* of the scientific system.[629] To say it in Luhmannian terms: wherever art reaches the limit of its demarcations it will be promoted in vindicatory rhetorics. These flash up in Japanese media art, as well as in 'art and technology' programs and in the art-sci field. Artistic research has to affirm its legitimacy confronted with a twofold difficulty. On the one hand, there is the premise of art's autonomy according to which art does not

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we show emotions. And also the art pieces. […] Now, we have many art museums, so the definition of art from Europe is getting very popular now. Of course, there are certain differences, also the tradition of art in society is totally different. But maybe the definition of art is getting much more similar than at the time it was imported in Meiji era.", Shikata in interview with the author, NTT ICC, July 22, 2009.

[628] Kusahara: intron.kz.tsukuba.ac.jp/vrlab_web/why.php. Also: "Device Art", in: *Das neue Ars Electronica Center*, exh. brochure, Linz 2009, p. 31. Cf. the section "A Glimpse at Historiography" in chapter I of this dissertation.

[629] Cf. exemplarily Sabine Ammon, "Was weiß die Kunst? Zur Relevanz künstlerischen Wissens in der Wissensgesellschaft", in: Heinrich Böll Stiftung ed., *Die Verfasstheit der Wissensgesellschaft* (Münster 2006), 72-88; Jill Scott, "Suggested Transdisciplinary Discourses for More Art_Sci Collaborations", in: Scott 2006, 24-35; Elke Bippus, "Einleitung. Kunst des Forschens", in: ibid., ed., *Kunst des Forschens. Praxis eines ästhetischen Denkens* (Zurich and Berlin: diaphanes 2009), 7-23.

serve any external purpose. On the other hand, research does pronouncedly serve the purpose of generating new knowledge. Caught in between, supporters of this fairly new field combine the two aspects into what then characterizes the specificity of 'art as research'. It does not pursue a rigid end, rather, while the artistic process follows a serendipitous approach, the outcome of newly generated knowledge (pertaining to the realm of the non-rational) is conceived as quasi-accidental. The difficulty of new art programs established at academies worldwide which operate in this field is to reconcile a paradox: to tackle the authority of scientific knowledge *and* to make use of this same authority through its language and scope. In structural similarity to a science which – as is recurringly stated – is also highly reliant on images, on the subjectivity of the researcher, and on creativity and chance, art can be research namely not by serving a confined end, but by allowing to unfold its intrinsic capabilities as a traditional means of shaping the world.[630] This is expressed in the wish to promote a new "system of knowledge", "xeno-epistemes", "fluid forms and alternative methodologies" not adhering to the classical disciplines.[631] Most often science's shortcomings are cited (preferably citing scientists themselves raising them) in order to then turn to where art performs better in the field of 'research'.[632]

'Art and science', 'Art & Technology', 'art as research' – the conjoining 'and' and 'as' cause the term 'art' not little legitimatory trouble. After all the conjunctions ensue antagonistic connotations. When artist Victoria Vesna repudiates any serving function of her and Gimzewski's artistic projects, she strives to re-install the very autonomy of the artwork in a context which inevitably challenges ontological ascriptions to art. Engineering professor and media artist Ken Goldberg who combines research and art in one person avoids treading delicate grounds by clearly separating his research and

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[630] For a critical discussion of Nelson Goodman's ideas of art as a way of "worldmaking" see Luhmann 1997, p. 491.

[631] Maria Hlavajova, Jill Winder, Binna Choi, "Introduction", in: ibid., eds., *On Knowledge Production. A Critical Reader in Contemporary Art* (Utrecht and Frankfurt Main: 2008), 6-14, p. 8 and 9: "the 'xeno-episteme' […] as an alternative, propositional definition of knowledge production as related to the contemporary visual arts".

[632] This is true especially for the intersection of artistic research and 'art and science'. Exemplarily: in Scott 2006: Beat Gerber, "Science in Trouble? Art Brings Hope", 47-49; Roger Malina, "Welcoming Uncertainty: The Strong Case for Coupling the Contemporary Arts to Science and Technology", 15-23. Also Elke Bippus, "Zwischen Systematik und Neugierde. Die epistemische Praxis künstlerischer Forschung", *Gegenworte. Hefte für den Disput über Wissen*, Spring 2010, No. 23, 20-24; Sommerer and Mignonneau, "If we knew what it was we were doing, it would not be called research, would it? Ein Gespräch mit Stefan Iglhaut", in: Iglhaut/ Spring 2003a, 60-67; Sommerer/Mignonneau 1998. Cf. also Bippus 2009, still taking the same line, but critically discussing the very problem of the matter.

his art.[633] In nanoart works, experience stays the crucial category, the lense through which the visitor partakes in the outlook upon an however shaped reality. The above-mentioned affinity with the religious inherent to the imagination of a beyond trickles down to sci-art and becomes part of the artwork alluding to the sublime. An aesthetic experience often in adjacency to spiritual momentum testifies to the notion that the 'and' in art and science certainly does not disenchant art; on the contrary, as shown, many installations unfold science's enchanting aura in the gallery space. In this gesture 'art and science' does not push any boundary. Art here stays true to its quasi-mystical ascriptions.

When Big Science and the industry become stakeholders in artistic practice, science's authority and consumer culture break into the museum. In 1979, in his evaluation of the 'postmodern condition', Jean-François Lyotard has described the annexation of science and knowledge by economic interests and the principle of optimization: "no technology without wealth, but no wealth without technology."[634] The utilitarian approach often linked to economic interests, which can be found in 'art and technology' exhibits at media art venues links art to purpose and unsettles its defining limits. Media artworks presented at fora like ISEA or Ars Electronica mirror efforts nowadays to redeem preexisting utopias. The discourse around Device Art in Japan and similar works of 'art and technology' illustrates how 'modern' debates of the early 20th century about ontological questions of art and its clash with the command of purposelessness are ongoing today.[635] 'Experience' as a charged category distinguishes mere tool (e. g. the *nanoManipulator* mentioned above) and the media artwork with its exploration of an enchanted space, aimed at aesthetic inwardness. Presented decidedly as 'art', much of 'art and technology' is consolidated in the paradoxical position between functionality and sublimation of experience. While the purpose-related functionalism of the early 20th century stood in contrast to ideas of the

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[633] To Goldberg, artworks like his microscopic silicon artwork *flw* are rather two sides of the same coin. As such *flw* can be displayed as exemplary research in a Bell Labs calendar and shown as a media artwork in the gallery; Ken Goldberg in an interview with the author, UC Berkeley, March 2, 2009.

[634] Lyotard 2004, p. 45.

[635] Efforts to reconcile art, life, and mass production by the Arts and Crafts movement, the Bauhaus, and similar endeavors, always ran parallel to those upholding art's autonomy. Norman Bel Geddes' ideas in the 1930s of an art and design of the future are illustrative of such ventures while every-day life for a long time now had been no longer separable from the effects of industrialization. In no way an opponent to scientific progress, John Dewey uttered his hopes for a sublimation of a life in routine through aesthetic experience – still ascribing redemptory powers to art in the face of modernity's estrangements.

'spiritual in art',[636] purpose-related art today equally faces legitimatory problems within the art world.

Here originates the claim of many media art theorists that the boundaries between art, technology, and design are dissolving. The artwork's inherent division of the world of objects into mere object and *art* object, the auratic charging of 'things', is something which the sociologist Niklas Luhmann describes as 'markings of difference' (*Differenzmarkierungen*) within the art system. "The imaginary world of art – just like in other ways also […] the world of religion – offers a position from which can be determined *something else* than *reality*".[637] This essential contrast which art has to uphold marks the above-described conflict of an art form oscillating between autonomy and the questioning of its boundaries.[638] The philosophically reinforced and ontologically necessary autonomy of art is affronted by internal efforts to realize this very autonomy "in the borderline case".[639] Quasi-religious residues and the quintessential meaning of sublimating experience for any 'art' on the one hand and its inclination toward a purpose on the other hand explains discrepant attitudes in and opinions of the intersection of art with science and technology.

The postmodern call for interdisciplinarity – Lyotard has described it as inherent to the 'epoch of delegitimation'[640] – pervades the field of media art, and especially that of 'art and science' and 'art and technology'. But while knowledge and science are highly significant productive forces of our societies, they ensue discursive regimes extending into the (media) art field, which privilege certain statements and sanction others.[641]

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[636] See for example the discrepancy between Kazimir Malevitch's ideology and the Bauhaus doctrine: "(wenn die Verwertung eines Kunstwerkes für 'praktische Zwecke' nicht mehr zweckmäßig erscheint), gewinnt das Kunstwerk seinen vollen Wert wieder.", Kasimir Malewitsch, *Die gegenstandslose Welt* (Mainz and Berlin: Florian Kupferberg 1980), p. 76. See also the preface by Stephan v. Wiese "Damit ist schon vom geistigen Hintergrund her klar, warum eine Begegnung, die zu einer 'Sternstunde' der Kunstgeschichte hätte werden können – nämlich die Begegnung zwischen Malewitsch und der Institution Bauhaus – keine solche wurde, sondern mehr oder weniger scheiterte. Kunst als archimedischer Punkt in Malewitschs Verständnis ließ sich mit dem vom Bauhaus praktizierten Funktionalismus kaum zusammenbringen.", ibid., p. VI.

[637] Luhmann1997, p. 229.

[638] Employing mathematical terminology, Luhmann calls this the 'unresolvable indetermincy' of an art which introduces the negation of the system into the system itself. Ibid., p. 474.

[639] Ibid., p. 475.

[640] Lyotard 2004, see p. 37 et seq.

[641] See ibid., esp. p. 42-47. A fundamental concern of Lyotard's analysis is to reveal the 'games of language' and linguistic agonism as well as the presumption "that the observable social bond is composed of language 'moves'", p. 11.

Media art projects are evidently inscribed into a Lyotardian 'postmodernity' regulated by science and technology as immensely important productive forces.

The poststructuralist has suggested to differentiate between two possibilities to disturb the functioning of the postmodern epistemic regime: *paralogie* and 'innovation'. The latter is generated by the system itself in order to optimize its efficiency. The former, as a form of dissent and inconsistency with the system, would be an objection to dominating forces. *Paralogie* is presented as a hope and necessary counterweight to the normative power of the dominant structure.[642] In a way, this dichotomy is reflected in the media art discourse. Calls for innovation through technological art contrast with voices ascribing to works of 'art and science' the role of a critic of dominant technologies and the scientific regime. It remains to be seen whether and how media art can live up to such ascriptions.

> The transgression (also) has to do with the fundamental crisis of art in the age of techno-culture, which as a fundamental crisis of modernity has generated postmodernity.[643]

Postmodernity follows modernity while art's role is being re-defined – media art theorist Peter Weibel discusses art in terms of the new 'technoscientific epoch' (Jutta Weber). Concepts of a 'Second Modernity' are introduced and illustrate an at times helpless trial to describe historical change and art's role in it. We reflect upon our 'world' and we write 'history' and in order to do so we revert to neat concepts and categories that have helped us to bring order into an otherwise ungraspable 'reality'. We struggle to evaluate the passing time. In his book *We have never been modern*, Bruno Latour has discussed such issues of a constructed temporality. He rejects the modern and the postmodern attitude as two sides of the same coin – as the propagation of progress and an uttermost disappointment about its deceptions, *and* as the attempt to overcome just this disappointment while staying indebted to its premises. Rather than upholding a conscious or unconscious belief in progress and linearity, he proposes to accept the anthropological constant of cyclic re-occurrence in 'history'.[644]

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[642] Ibid., p. 145 and the following.

[643] Weibel 1991, p. 205.

[644] Latour 1993, esp. p. 70-76.

While Latour's contribution reads like a manifesto calling for a new regime of thought beyond the old epistemic categories,[645] also Hans Ulrich Gumbrecht's above-mentioned ideas on what he calls the "post-historicist chronotope" (that is, the contemporary impression that the future is no longer a space of open possibilities) are an assessment of our perceiving the past, the present, and the future. The focal point of the theoretical positions presented in this study – Gumbrecht, Nordmann, Lyotard, Latour – is indeed a reflection upon 'time', upon anthropological constants in the individual's assessment of temporality, upon the 'epoch' of rationality and technology. The thought regime originating from this 'epoch' is assessed as dominant and oft described as a menace to future development and freedom. Do concepts of postmodernity like that of Lyotard though correlate with Gumbrecht's post-historicist chronotope? All of these conceptions are based on the proclamation of a rupture, of a change in the contemporary perception of our world. Although his *Condition postmoderne* was written more than thirty years ago, I have taken Lyotard as the point of origin for my concluding remarks on media art and on a period which is most often described as 'postmodern'. Lyotard coined the term with a specific concern for 'knowledge' in postmodernity. The fields 'art and science' and 'art and technology' can be seen as a manifestation of the postmodern thought regime. Undecided whether they represent paralogical functions or step into the footsteps of time's call for innovation, they do not seem to fulfill Gumbrecht's observation of a change in our perception of the future. The techno-aesthetic appearance of such media art works presented at international media art festivals certainly still points to spaces of technological possibilities. Nor do the two fields redeem Latour's utopian call for a new practice of conceiving the hybrid in nature and culture. 'Art and science' and 'art and technology' as an allegedly 'postmodern' art stay true to models of progressing linearity and to 'the project of modernity'[646]. In general, they convey a *belief* in the power of science and technology,[647] and as such must stay – *bien sûr* – children of their time.

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[645] Latour promotes the big 'Both…and' which renders his argumentation often fuzzy and unempirical. His grand philosophical overview is interspersed with rare concrete examples, reflecting upon both, temporality as such *and* current socio-environmental problems like the ozone hole.

[646] See also Daniels 2002, p. 154-161.

[647] Cf. Latour 1993, p. 125 and the following.

Epilog

Two studies of art realizing art's very autonomy "in the borderline case" – the two cases of 'art and technology' and 'art and science' with their distinct characteristics presented in this dissertation were chosen as exemplary insofar as I assume that they be representative phenomena not of a totality, but of a major section of the media art field. I have analyzed efforts of combining technology and art by looking at Japanese Device Art, which serves as an umbrella term for potentially commercializable artworks ranging from tiny gadgets like Ryota Kuwakubo's *Bitman* to more elaborate research endeavors like Hiroo Iwata's *Media Vehicle*. Many of these media art works mirror the presence of technological research at international media art festivals in the form of projects presented by engineers in order to promote their work often co-financed by the industry. I have shown how artists, curators, scholars, and researchers strategically position themselves in the field, rhetorically and through their works, in order to make ends meet in a funding context reflecting economic and also national interests. The media art arena becomes a platform for Device Art's promoters and their respective position-takings in this subfield of cultural production. Rather than encouraging technological development through military funding, Japan has largely invested in the development of consumer culture with the result of a striving economy until the burst of the bubble in the late 1980s – and, despite an ongoing crisis, even until today. Device Art is only one example of economy's arm reaching into the media art field. At the same time, within the context of my analysis the ethnocentric groundedness of the term 'art' once more has become evident. The corresponding terms 'bijutsu' and 'geijutsu' were only introduced during Japan's Meiji era in the second half of the 19th century and were installed to describe a concept alien to the island's history of ideas. This fact and subsequent tropes of *nihonjinron* – the 'discourse of Japanese-ness' – are considerable facets in the investigation of an art form staged as intrinsically 'Japanese'. The eurocentricity of my view on the matter cannot be dissolved, although I have at any point tried to stay on an observational level and not enter the terrain of value judgment.

In the second chapter of this dissertation the phenomenon of 'nanoart' has illustrated the flourishing marriage of art and science in a field of media art singing the swan song of Charles P. Snow's Two Cultures theory. While the call for interdisciplinarity has been pervading academia for decades, many works of nanoart (I have focused on installation pieces) are good examples of co-operations between artists and scientists

engaged in a dialogue of their disparate disciplines. *Nano-Scape*, *Blue Morph*, or *Nano_essence* are media art works that introduce nanotechnology into the gallery space. This introduction takes place in a metaphorical 'translation' of scientific images and concepts which are supposed to render the nano'world' *experience*able for the visitor. The installations do not, however, display the techno-science as a cold function of a technologized society. Instead, we marvel at icons of a science re-enchanting the world. With an omnipresent buzzword – 'nano', Big Science arrives in the art world much like in the works trading under the name of bioart in reference to the Life Sciences. Players in the field of 'art and science' take positions in the context of media art venues and science museums. They are almost always in one way or the other related to academia. It is also academia and science foundations which cross-finance a majority of these art projects through residency programs, exhibitions, and the sponsorship of interdisciplinary nodes. Nanoart is often displayed in the science museum and points to the increasingly important role that art has recently assumed within such spaces for the popularization of science.

I have examined two subfields of media art as an arena of cultural production, not their artworks as the subject of aesthetic experience. I have stuck to this approach also in the third chapter, which comprises a survey of the discursive lining of such media artistic endeavors with respect to visions of future and progress. Japanese Device Art and international nanoart, artistic currents in close dependence on contemporary developments in technology and science, each emerge as an art of the future operating with science's and technology's underlying beliefs in progress. Art in proximity to technological advancement and design as well as works focusing on cutting-edge 'technoscience' have for the most part neither broken with modernity's utopia nor with science's promises. We encounter visions of a future which has never ceased to be a space of open possibilities,[648] never lost its "utopian excess-potential".[649]

Inevitable tensions underlying a justaficatory discourse in the field are caused by the complex interplay of connotative nuances in the combination of *art* with the counterparts *science* and *technology*. While 'art' is imbued with ideas of an however shaped autonomy and is an end in itself, its reflection of nanotechnology or mass

[648] See above, Chapter III.1 and Gumbrecht 2008.

[649] Koselleck 1989, p. 367. Koselleck here refers to the divergence of 'experience' and 'expectation' surfacing in the conception of 'progress'. Changes in the modern age have rendered it necessary to *cope* with this divergence, with the new experiences, leading to the emergence of the notion of progress.

produced gadgetry, or more generally: its flirt with science and technological development necessarily bring about trespasses into border-zones of conflict.

Programmatic ideas and hopes that have been projected onto media art range from eulogies on innovation to emphases on its critical function in a 'technoscientific age'. The latter would be an almost *paralogical* function in Lyotard's terms. According to the French philosopher, societal 'knowledge' has undergone a significant shift in postmodernity. Lyotard's main point is that it is considerably marked by the influence of the "technological transformations" of the 20th century.[650] He proclaims a new historical period by understanding "scientific knowledge" and "narrative knowledge" as two different discursive regimes. While science once was dependent on narrations (on the epos, on philosophy) in order to legitimize itself, now the "grand narrative has lost its credibility".[651] The decline of the 'grand narrative' coincides with the return of unhindered capitalism in the 1960s and ensues an unknown alliance of money and knowledge.[652] Big Business has become a player in generating new knowledge. Beat Wyss notes that Lyotard's postmodernity thereby begins around the same time in which Charles P. Snow holds his famous lecture on the 'Two Cultures' in the late 1950s.[653] The hegemony between them has clearly shifted toward the scientific side. In the era of scientific knowledge, the grand narrative has to be superseded by the *paralogie* in opposition to the normative discourse.[654] When media art is furnished with a critical function, when 'art and science' projects are supposed to question the dominance of their very subject matter, it is debatable whether it is ever able to play the paralogical role ascribed to it. I have shown how also in the field of art toying with technology and science economic factors exert a vital influence on rhetorics and narratives. With Lyotard I would argue that the 'technological thought pattern' more than anything else makes these art forms an expression of postmodern knowledge which they do not escape.[655]

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[650] Lyotard 2004, p. 4.

[651] Ibid., p. 37.

[652] Ibid., p. 45 et seq.

[653] Beat Wyss, *Nach den großen Erzählungen* (Frankfurt Main: Suhrkamp 2009), p. 13.

[654] Lyotard 2004, p. 60 et seq.; Wyss 2009, p. 16.

[655] Although he makes no reference to it and although he comes to a more pessimistic appraisal, Lyotard argues in a similar way as does Heidegger before him when he talks about the *Gestell* of technology pervading our epoch. Also in Heidegger's exposition, art is endowed with capacities countering 'technology as destiny'. Cf. Andreas Luckner, *Heidegger und das Denken der Technik* (Bielefeld: transcript 2008), p. 119-123.

After a glance at innumerable and recurring assessments of the present with respect to an imagined future, in the face of an allegedly constant radical change – from the industrial revolution and the coalescence of the world in speedy transportation to after-war developments of computation, fiber glass networks, and the Internet, not to speak of science's latest accomplishments in nanotechnology and the life sciences – media art is positioned as another central protagonist. From a historiographical as well as a philosophical perspective, however, it is worthwhile taking a step back and questioning the very meaning of this 'change'. In contrast also to Lyotard, I do not want to strike the note of cultural pessimism and aim at a normative re-evaluation of what art is and what it has to be. I want to propose a simple appraisal of our present: a present not subjected to breathtaking change at all, rather a progression of time within a process of rationalization ongoing for centuries now.[656] In consequence, our indebtedness to 'technological thought' as a 'destiny' comes to light especially in a field in which art intersects with science and technology. The plurality of voices in the field cannot but resonate with this thought pattern. In the functionalism of Japanese Device Art, in installations relating to the marvels of the nanoworld, in the euphoric tone of Roy Ascott and Peter Weibel, or in artistic collaborations in labs surfaces the conception of art as a concomitant agent of our technologized time. This 'art of the future' with its dependence on a science and technology in progress (the latter being intrinsic to its operating means) is embedded within the 'postmodern condition'. It is indeed a reflection of our current time, not more and not less.

In which way is this art of the future meaningful for the present? As Niklas Luhmann has put it twenty years ago: In analogy to our postmodern society and against the background of an 'unresolvable indeterminacy' when a system negates itself, 'art & science & technology' today mirrors the estimation "that the future is no longer guarantied by the past, moreover it has become unpredictable."[657] Unpredictable open spaces awaiting us, one may at least ponder upon what media art tells us about the present.

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[656] As states Max Weber in 1917. Although I do not agree with Latour's ambitious yet diffuse promotion of a "Parliament of Things" (Latour 1993, p. 142 and the following; also Latour 1999), my stance here concurs with his remarks on the modern as well as postmodern belief and disappointment in progress.

[657] Luhmann, p. 499.

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Curriculum Vitae

Personal Details

Nationality German
Date of Birth September 27, 1982
Place of Birth Wolfenbüttel, Germany

University Education

February 2008 - March 2011	University of Zurich, Institute of Art History PhD Candidate in Art History
September 2004 - Oct. 2005	Université François Rabelais, Tours, France Studies of Art History and Sociology
April 2002 - February 2008	University of Leipzig, Germany Studies of Art History, Sociology, and French
October 2001 - March 2002	University of Trier, Germany Studies of Art History, Sociology, and Media Studies

Degrees

March 2011	Dissertation and doctoral defense on the subject of *Media Art and Future Technologies. Art at the Interface Between Lab and Gallery* with Prof. Dr. Philip Ursprung (ETH Zurich) and Prof. Dr. Dieter Daniels (Academy of Visual Arts, Leipzig)
August 2007	Master of Arts, University of Leipzig, Germany M.A. Research Thesis *The Representation of Disappearance. The* Desaparecidos *in Contemporary Art in Argentina*
July 2003 / February 2004	B.A., University of Leipzig, Germany Double Major and Minor Program in Art History, Sociology, and French

School Education

September 1994 - June 2001	Wilhelm-Gymnasium (High School), Brunswick, Germany 'Abitur' (University-Entrance Diploma) "Grosses Latinum" (Latin, highest proficiency level)
August 1998 - June 1999	Mount Greylock Regional Highschool, Williamstown, MA, USA

Scholarships

June - August 2009	Research Fellowship of the Japan Society for the Promotion of Science for research in Greater Tokyo, Japan
February 2008 - March 2011	Stipend of the Swiss National Science Foundation, doctorate school *Pro*Doc 'Art & Science'*
August - October 2006	Stipend of the DAAD (German Academic Exchange Service) for Master's thesis research in Argentina

Professional Experience

since February 2011	Institute of Art History, University of Zurich Senior Assistant / Lecturer
June - August 2009	Research stay in Japan, funded by the Japan Society for the Promotion of Science (JSPS) Research Fellowship
April - September 2007	Simon Dubnow Institute for Jewish History and Culture associated with the University of Leipzig, Germany Student Assistant
August - October 2006	DAAD (German Academic Exchange Service)-funded stay in Buenos Aires, Argentina to do research for the Master's thesis
February - April 2006	Daros-Latinamerica Collection, Zurich, Switzerland Internship
May - July 2005	Centre de Création Contemporaine, Tours, France Internship
Summer Term 2004	Institute of Art History, University of Leipzig, Germany Student Assistant
August - October 2003	Verlag für moderne Kunst Nürnberg, Germany Internship
September/October 2002	Kunstverein Hannover Internship

Publications

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